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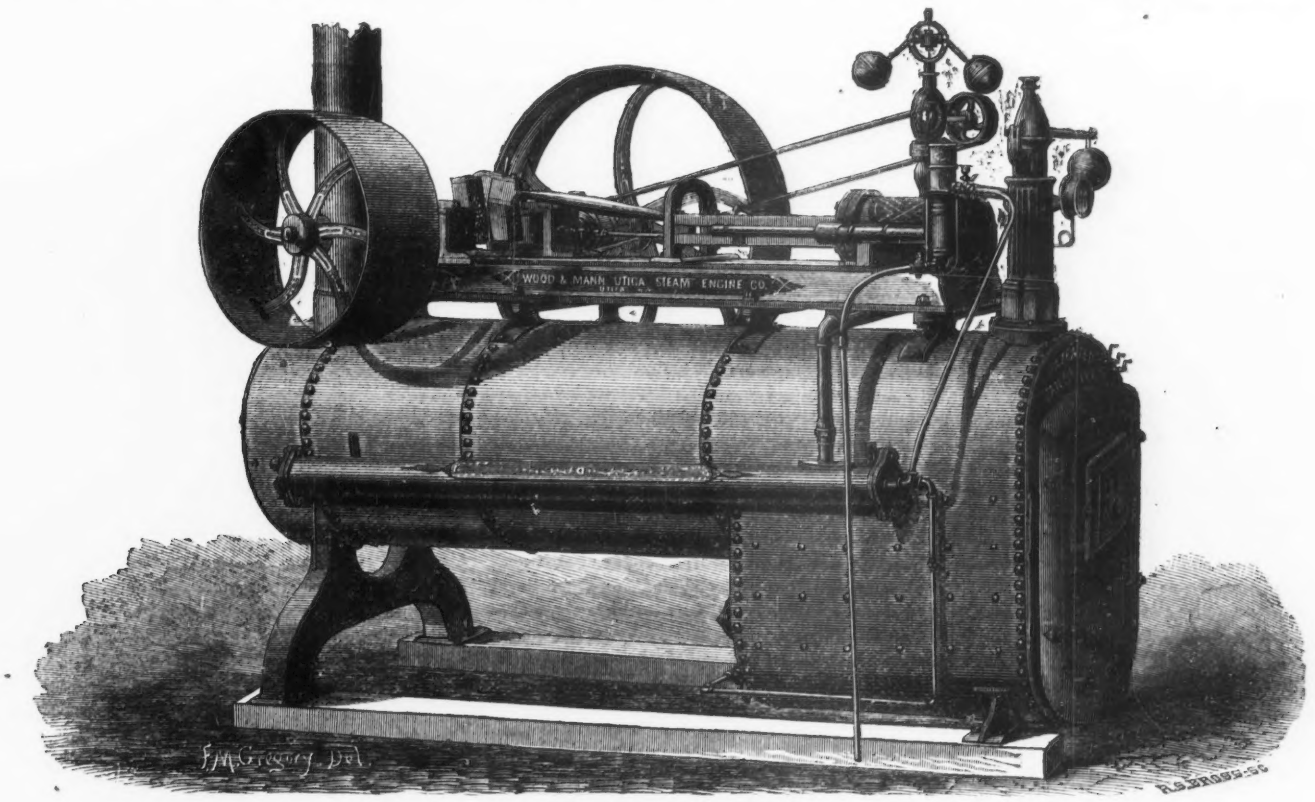
Portable Steam Engine.

THE accompanying engraving represents a portable engine, manufactured by the Utica Steam Engine Company (formerly WOOD & MANN) No. 42 Cortlandt street. We are indebted to Mr. SAMUEL F. BAGG, Manager, for the facts upon which the following description is based. As will be seen by an inspection of the cut, the engine is provided with a bed-plate which rests on the boiler, and is attached to it by means of bolts passing through three or more brackets. The entire engine can be easily removed from the boiler and used separately as a stationary engine, if desired.



PORTABLE STEAM ENGINE.

The guides for the cross-head are of the usual locomotive pattern, one end made fast to the cylinder, the other secured to a stand. The Piston is of the three ring and spring pattern. It can be readily adapted to any wear of the cylinder. By using cast steel for the piston rods the builders are enabled to make them much smaller than if made of iron, occupying less space in the cylinder and keeping its area more nearly alike on both sides of the piston. The Connecting Rod is made of the best refined wrought iron, is proportioned and fitted with the greatest care, and is furnished with boxes of the very best bronze. The Governor, one of the most important features of an engine, is placed over the valve, which is anti-friction. Its attachment is direct, avoiding the use of levers from which loss of motion might ensue.

The Main Crank Shaft is double and is forged from scrap iron, cross-piled and hammered into solid slabs of suitable size; the center is then cut out by machinery, leaving the crank without weld or seam. These crank shafts are larger than is usual, and extend far enough on either side to receive an additional pulley. The boxes are unusually heavy, giving a very long bearing. The heater consists of a large cast iron pipe, bolted to the boiler and entirely separate from the bed-plate. Through this heater, which is filled with exhaust steam from the engine, the water is carried in a smaller pipe from the pump to the boiler. The pump is driven from the cross-head, and so arranged that either valve may be removed without disturbing the other. A cock is placed in the supply pipe, making the pump self-acting under equal loads, and keeping the water in the boiler always at the same level. The valves and valve seats are of brass, the valve surrounded by a brass cage to keep it in position. It can be easily removed at any time by loosening a single screw.

The boiler is built from the best quality of American boiler plate of extra strength. It is made after the locomotive pattern with the addition of a circulating water bottom. The sides of the furnace are braced or stayed with three quarter inch stay bolts at intervals of six inches. The Crown Sheet is stayed with wrought iron crown bars in the form of a truss, so riveted to the sheet that the water has a free circulation around them. The furnace is surrounded with a water space of three to four inches. The front is cast in two pieces and bolted together, being far less liable to crack than when made solid. The fire doors are double, lined with a heavy perforated plate, admitting the air, which ignites all gases and keeps the doors from over-heating.

The smoke chamber, at the rear end of the boiler, is formed by the extension of the boiler shell. The manufacturers insert within this chamber an arrangement called an Exhaust Steam Blast, by means of which these boilers are enabled to make and maintain steam as easily with six feet of smoke pipe as others with forty.

The Manufacture of Iron and Steel Rails.*

In order to get an idea as to the strength of steel rails, it will be well to review the tests to which iron rails have been subjected. In England, Mr. ASHCROFT found that the best 80 lb. rails broke under a 300 pound weight, falling 15 feet. In Germany the society of railway managers determined on and have long applied a test of 1,000 lb. falling 10½ feet, as the standard which all first-class iron rails must reach. In this country no inspection nor test is applied, but tests made show that iron rails from our most reliable makers, break under a 6 foot fall of a

* A paper, read before the American Institute of Mining Engineers, at Philadelphia, Feb. 21, by J. B. PEARSE, Esq., of the Philadelphia Steel Works.

1,500 lb. drop as an extreme test, most of those tested breaking under a far less test; some breaking with less than a 3 foot fall of the same weight.

Everywhere where steel has been used, engineers have come to the conclusion that some test is required to show the regularity and strength of the product. As compared with iron, the tests which steel will stand are wonderful. After numerous experiments partially based on the experience of the rail mill at Graz, belonging to the Southern Railway of Austria, the society of German railway managers fixed upon a test of 2,000 lb. falling 13½ feet. They found that this test represented the steel which suited their necessities, and also found that with steel of otherwise average purity, this test represented about ½ per cent. of carbon, and made it a rule to take no steel containing under three-tenth of a per cent. of carbon, because it was too soft. They expressed a hope that a harder steel could soon be made tough enough to stand the same test. In England, a test was adopted of 2,240 lb., falling 15 to 17 feet on the rail on heavy bearings. This test has been found satisfactory under heavy traffic on average road beds, and has been invariably retained by English makers, and adopted by American makers. It is an expeditious practical way of ascertaining the qualities of the rail. Experiment in Germany and experience in England pointed out the test corresponding to the proper grade of steel, and the test adopted has been considered the most practical one. The jar from a moderate weight (2,240 lb.), falling from a great height, is more sudden than that imparted by a heavy weight falling a small distance and better adapted to exhibit the toughness of the rail. This latter is the object had in view in all tests, as it would take far too long a time to determine the quality of rails by a treatment approximately similar to that received in the track. An objection of some force has been urged against the English method of obtaining test pieces. They take one rail from each day's rolling, to indicate the quality of the rest. In this way their test becomes a matter of chance, and nothing they have yet done removed this character. Our American practice has been to test every charge, thereby ensuring beyond doubt the quality of the rails.

After a short experience with steel rails it was found that their homogeneity is their distinguishing characteristic; but they unite entire homogeneity with considerable hardness as compared with iron. There are no layers to peel off, no welds to open out, the ends of the rails do not broom out as iron rails do, and the head wears uniformly along its whole length. Not only is the single rail entirely homogeneous, but all the rails made from a single charge have exactly the same qualities. Many experiments on the steel at Seraing in Belgium, in Austria, and in this country, before and after its conversion into rails, show this to be a fact.

But the hardness is a most important point as regards wear. Some first rate English rails have been found too soft for roads with heavy traffic. Therefore, a rail is wanted which will be hard enough to stand abrasion and wear, but strong enough to stand all the strains to which it is liable. The railroad engineer's idea of hardness is that quality which imparts durability without brittleness. Hardness is sometimes erroneously associated with brittleness because some hard bodies are brittle, but in steel brittleness arises from causes entirely different from those which produce hardness. The steel maker's idea of hardness is a composite one—one that results from considering the effects of physical structure or grain of the steel, and the effects of carbon, phosphorus, and manganese. The effects produced by the presence of these elements far exceed any brought about by change of physical structure. Phosphorus and manganese occasion brittleness, while carbon in excess is seldom present, as the processes through which the rail passes have a constant tendency to reduce it. The state in which carbon is present in the rail is, however, remarkably influenced by mechanical treatment and the resulting physical structure. Those modes of reduction which work quickly and forcibly exert a strong influence to retain the carbon in a combined state, while the slower methods on the contrary permit some of the carbon to separate as graphite. These facts have been observed by GRUNER and CARON, and have been corroborated in Austrian practice, as the following analyses of steel will show:

(*a*) Steel made for heads of steel rails at Graz, and rolled into shape without hammering:

Combined carbon	0.38
Graphite	0.65
Silicium	0.05
Manganese	0.07
Sulphur	0.05
Copper	0.08
Iron	98.57
	99.85

(*b*) Steel made at Neuberg and hammered into shape:

Combined carbon	0.234
Graphite	none
Silicium	0.033
Phosphorus	0.044
Sulphur	traces
Manganese	0.139
Copper	0.105
Iron	99.445
	100.

Both th ese steels were soft Bessemer steel, and from observation I made at the two works on the respective quality of their metal, I see no reason to doubt their correctness. A remarkable point in the matter is that their iron at Neuberg was much more graphitic than that used at Graz. At Neuberg they tapped direct from the blast furnace, and their "blows" averaged about thirty minutes, some running up to fifty minutes. At Graz they remelted their iron in an air furnace, and their "blows" were much shorter. The iron each works used was then of substantially the same character, made by charcoal from spathic ore. Neuberg made its own iron, while Graz bought its iron largely from Mariazell and Eisenerz, furnaces not far from Neuberg.

Now, at the Pennsylvania Steel works, we have a quite graphitic mixture for conversion, but we find scarcely any graphite at all in the rails—in fact none. Out of many tests we have only one, an apparently abnormal one, in which the graphite amounted to 0.08 per cent., it being generally present in too small quantities to be estimated.

Speaking within the limits of steel manufacture, it is safe to say that brittleness has nothing to do with the mechanical treatment, yet by this treatment the state of the carbon may be controlled and the specific gravity and consequent density of the steel increased. Rails are brittle when too cold-short from the presence of phosphorus and manganese. The proper proportion of the former forms the most delicate point in steel making, and must always be kept within safe limits. No good steel rail has ever yet been made with more than one-fifth of one per cent. of phosphorus, and half that is considered too much by BESSEMER. In regard to manganese, our experience is not yet fully ripe. Its action, however, is far less dangerous than that of phosphorus, and in small quantities is beneficial.

We have thus a definite idea of the important qualities of steel rails and the proper tests to show their uniformity. The tests made on the steel preclude possibility of brittle steel being used, and it is evident that those methods of reduction which unite the greatest hardness with the necessary strength are to be preferred. In general terms, a steel rail is wanted to last a lifetime, and to be strong enough to stand all accidents of wear.

Railmaking begins with the BESSEMER ingot. This is a block of highly crystalline metal, the tensile strength of which is low, and which contains some blow-holes or bubbles formed by the carbonic oxide retained by the liquid steel. The inner surface of these bubbles is generally oxidized, and they are apt to be more numerous near the surface of the ingot.

The first steel rails made ten years ago were treated like cast steel. Until 1863 they were made from ingots seven to eight inches square and four and a half feet long in four heats. In the first two heats the ingot was hammered down to size, one end at a time, and swaged in dies to the shape of the first pass of the rolls. Then the bloom, by this time eight feet long, was rolled in two heats through twelve passes into a finished rail.

This process was excessively crude, wasting everything a steelmaker cares to save, and as the rails were found deficient and their weak points tested, it was found that the small size of the ingots and the little work done on them caused a great number of imperfect rails and a very poor quality in the steel. At this time the expressions of want of confidence in Bessemer steel took shape. We have now, however, surmounted all difficulties, and produced a reliable uniform quality of steel in enormous quantities considered in the light of former capabilities of production. We now use very large ingots, which necessitate thrice the work formerly applied. In 1867 the ingots were raised in England to ten inches square, and in 1870 to twelve inches square, which is the size in general use. In America we have had exactly the English experience with small ingots, the efforts to use them to advantage having entirely failed.

Seeing, then, that large ingots weighing three-quarters of a ton, and making two rails, have been found necessary, it has become a question as to what mode of working them up gives the best results. I think that hammering furnishes the preferable product, and my present experience goes to justify the opinion. Rolling is preferred by some makers because it is thought cheaper, but I think the better wear of a hammered rail is a strong point in its favor. Rolled rails are generally softer than hammered rails, for the reason I have given—namely, because their carbon is apt to be partially separated as graphite, and their density is less.

There have been, in the history of iron metallurgy, two noted contests between rolling and hammering, in one of which the hammer came off victorious, in the other the rolls. I refer to the manufacture of hammered iron and to that of armour plates. Hammered iron is a necessity for smith work, and the qualities imparted to it by continued piling and hammering are wonderful as compared with ordinary iron. The reputation of the Low-Moor and Yorkshire iron tyres and plates is world-wide, and the steel tyre had in the Low-Moor tyre for some time a formidable competitor. In this case the benefits are produced by a better texture of the iron and greater ductility developed by the work done. The cinder is thoroughly expelled in the blooming and first piling, and may be left out of the question. In the other case the object was to get as soft and wax-like an armour plate as was consistent with the strength necessary to resist the impact of the shot. As the work done by the shot generally used represents in foot pounds the effect of one (gross) ton falling a mile and a half, it will readily be acknowledged that there is little similarity between the case of an armour plate and a steel rail, which has to stand a ton weight falling only 17 feet.

In my own experiments on the effects of the two processes, I compared ingots of the same steel with an average area of respectively about 75 and 110 square inches, average section, as they were the only moulds I had at the time to compare. I found that the rails made of blooms, hammered from the ingots of the latter section, stood over 100 per cent. more than the rails made direct from the ingot. The bloom was hammered to the size of the ingot,

and each rolled in two heats, one of them a wash heat, into the same kind of rails. I tested in this way 31 different charges. Weight used was 2,000 lb.; bearings, 2 ft. apart. The rails from ingots stood 21½ feet fall of this weight, showing 1 6-10 of an inch deflection without breaking. The rails from the blooms stood a 43 foot fall of the same weight without breaking, and showed a deflection of 3 9-10 inches. This leaves a surplus of 50 per cent. in favor of the hammered rail, deducting 50 per cent. for amount due to difference of area of ingots. To show the connection, on a manufacturing scale, of these tests with the actual result, I would remark that we made 13,285 rails out of the ingots of 75 square inches average area. Of these there were rejected by the railroad, for insufficient strength after delivery, 178 rails or 1 1-3 per cent. Of the larger ingots we had made up to the fall of 1870—34,320 rails, and had rejected for all causes, after delivery, only 18 rails, or 1-20 of one per cent., or a quantity only 1-26 as large as before.

We therefore continued to hammer, but now use an average section of 150 square inches; doing ⅔ the work under the hammer, and only ⅓ in the rolls. Our rails thus produced stand a ton weight falling 17½ feet, and leave an ample margin of reserved strength. We have had recent tests, in which the rail stood what was equivalent to a ton weight falling 70 feet without breaking, but have not yet got up to the armor plate standard of a mile and a half. Out of a lot of 1,200 tons of 58 and 60 lb. rails, not a single rail, out of the 439 tests given, broke under a ton weight falling 16½ feet. We have since had many similar series.

The bubbles in the ingots give some trouble in the subsequent working, sometimes occasioning cracks in the ingot requiring to be chipped out. This we do, as we hammer the ingot down, without hindering the hammer in its work. Rolls are apt to laminate these bubbles instead of forcibly compressing them like the hammer, and it sometimes happens that the bubble breaks out on the surface of the bloom and causes a long streak where the metal is not sound. These streaks are especially noticeable in the head of the rail. In order to obviate the cracks resulting from these blowholes, a hammer must be associated with the rolls to chip out bad places; and this renders the rolling process more complicated than it would appear at first sight. I do not see why it is not simpler to do all the work under one tool, namely the hammer.

The objections to hammering on the score of cutting sharply into the metal are not, in my opinion, of weight, as our experience agrees with the English, that you can hardly have too heavy a hammer for steel. We can strike two full blows of a 12 ton hammer on the same place without deforming or injuring the bloom in any way, or making a mark on it deeper than ⅜ inch each time. As showing what steel will stand, I will say that I have seen, in Vienna, Haswells hydraulic press reducing ingots from 10 inches thick to 2 inches at one squeeze, without injuring the steel, which was from Neuberg. It is thus surely idle to talk of a hammer as injuring steel in any way. The stroke of a heavy hammer works uniformly through the bloom, drawing the interior as much as the surface. We want to make a hard and tenacious bloom, and the concentrated blow of a heavy hammer is well adapted to that end. We lose practically nothing in ductility as compared with the rolls, and have ample room within the limits of our strength. The chemical composition controls the brittleness of our rails, and as long as we keep that right we can make a comparatively hard rail well adapted to wear.

In regard to the amount produced by the two methods in the same time, the hammer compares very favorably with the rolls. A blooming mill turns out about 55 tons of blooms a day from ingots. We do as much as that daily under a 12 ton hammer, and have done much more than that for a considerable time, so that the relative capacity of the two is hardly decided as yet. In 5 to 6 minutes we can hammer down, chip and cut in two, and carry away a large ingot reducing it to one-third its former size; and in 35 to 40 minutes do the whole work of getting a heat of 5 ingots hammered complete into finished rail blooms requiring no subsequent hand-chipping. For three months this hammer did an average of about 70 tons of rail blooms per day, turning them out sound and well chipped.

As a matter of interest, it may be well to refer to the fact that at Neuberg, in Styria, they use a 19 ton hammer on steel, and according to published statements, produce under it in a week only 65 tons out of 2 furnaces in 11 1-3 turns. They hope by using 4 furnaces to get up to 130 tons a week. It shows well the spirit of American work to compare our product with this. We do now over three times as much as they hope to do, and do it under a hammer of under 2-3 the weight. The weight of ingots is about the same.

I have explained above my reasons for preferring hammered rails, all derived from experience capable of easy verification. In practice we have found as far as we could compare hammered with rolled rails that the former stand the treatment they have to suffer better than the rolled rails. From experience with rails of different making, rolled and hammered from ingots of the same size, I am enabled to say that the hammered ones have far less rejections on all accounts than the rolled ones, and that their strength against sudden jar is greater.

I believe, therefore, that the hammered rails are superior to the rolled in very important characteristics. I do not deny that rolling may be improved so as to equal a hammered rail. That is not impossible nor improbable.* It has not done it yet in my opinion, but when it does I shall be most happy to change my opinion.

In order to show the relative endurance of iron and steel rails, I would like to mention a case that may be regarded as furnishing an American experience of steel rails, equalling that had on the English railroads, and especially on the London and North Western. The Philadelphia, Wilmington, and Baltimore railway laid in their yard in Philadelphia, steel rails on one side of the track, and iron rails on the other. The steel rails were hammered rails, and, were with the iron, laid in 1864. The steel rails wore out some 17 sets of the iron rails, and then the Company stopped the experiment, laying steel on both sides.

On a curve of 525 feet radius, steel rails have lasted intact since 1865, and are as perfect as when laid, where iron rails had before lasted only from three to six months.

None of the rails of the Pennsylvania Street Company, nor of any other company in this country, have ever been worn out by traffic or shifting work, so that I can, after a five year's experience of American makes, have reason to believe they will last at least a generation, under the hardest service.

Ellis's Bi-Sulphide of Carbon Engine.*

DR. VAN DER WEYDE—Mr. ELLIS, of Boston, has lately constructed a Bi-Sulphide of Carbon Engine, using the waste steam from the engine to heat the bi-sulphide of Carbon, and work another piston attached to the same engine. There have been two objections made to this, which I wish to answer. One objection is that we might just as well have two steam cylinders, making a compound engine, the steam from a high pressure engine working a low pressure engine. The other objection is, that if we are to use the bi-sulphide of Carbon, we do not need the steam, and I will reply to this objection first. Volatile substances require very little heat to convert them into vapor. Water requires a temperature of 212 dgs. to vaporize at atmospheric pressure, and 966 units of heat become latent. But ether will vaporize at 96 dgs., and only 165 units of heat are required. That is an immense saving of fuel. On that idea, some fifteen years ago, an ether engine was built at the Novelty works in New York. But practical difficulties came up. First, it was difficult to get the joints tight; and when it leaked it took fire, and alarmed every one. Another difficulty was that the latent heat was so much by weight, and the vapor of ether is nearly seven times as heavy as steam. It is a curious property of vapors, that whatever the temperature of vaporization, and whatever amount of heat becomes latent, in units, the amount of latent heat in a cubic foot of vapor, is always the same; and as engines are driven, not by the weight of the vapor but by its volume, that takes away all the supposed advantage of volatile fluids with regard to their latent heat.

The first objection was that we might as well use the steam from a high pressure engine to drive a low pressure engine. The simple answer to that is, that all the pressure you get from the waste steam becomes back pressure on the first engine, and you have all the machinery and friction for nothing. But if you pass your waste steam freely through tubes which heat bi-sulphides of carbon, there is no back pressure, and the pressure you obtain from the vaporization of the bi-sulphide of carbon, is a clear gain. FAIRBANK & DUNKIN in England founded a method of judging of the performance of steam engines, by measuring the water of condensation, as it was done in the recent trial at the American Institute Fair. In the best steam engine, the water of condensation is warmed somewhat, and that amount of heat is lost. Now let us see what is the pressure with different vapors:

Ether.	Bi-Sulphide of Carbon.	Water.	Pressure.
95 dgs.	110 dgs.	212 dgs.	1 atmosphere.
115 dgs.	130 dgs.	270 dgs.	2 "
125 dgs.	140 dgs.	265 dgs.	3 "
133 dgs.	148 dgs.	280d gs.	4 "

Now if we take the steam at 212 dgs., you see that it will produce a pressure of much more than four atmospheres in the bi-sulphide of carbon. It is asserted that by this engine, a nearer approach has been made to theoretic perfection, in the power produced, than ever before.

Mr. FISHER—What is the odor of bisulphide of Carbon.

DR. VAN DER WEYDE—It is very offensive, and has a paralysing effect upon some parts of the system; but it is confined to the condensing engine, and ought not to get out.

The PRESIDENT—MR. HUGHES, of Rochester, undertook to use the heat from waste steam to evaporize the bi-sulphide of Carbon, and after a great many trials, came to the conclusion that the same amount of heat applied to water, would do just about as much.

Mr. T. D. STETSON—Mercury boils at about 600 dgs. Fahr.; Sulphuric acid at about 300 dgs.; Water at 212 degs.; Alcohol at 180 dgs.; bi-sulphide of Carbon at 110 dgs.; Sulphuric ether at about 90 dgs.; the hydrocarbons at different temperatures down to freezing; and carbonic acid at 148 degs. below zero. It is impossible in practice to communicate all the heat from one fluid to another, but by passing it through very small tubes, and thin vessels we may transfer a large part of it. Now suppose we make our fire under a boiler to volatilize mercury, at 600 dgs. and upwards, and exhaust right down to atmospheric pressure. Then we may take the exhaust from the mercury, and obtain a vapor from sulphuric acid, which will give us additional power. Exhaust from that to atmospheric pressure, and it will make steam at 300 dgs., a pressure of four or five atmospheres. The exhaust steam at 212 dgs. gives us a pressure of several atmospheres in heating bi-sulphide of carbon; and, so we may go on, step by step, down the scale until we read a point, where we shall find a difficulty in condensing; for something will depend

*From the transactions of the Polytechnic Club, Feb. 16, 1872.

upon our supply of cold. Working in the winter, on the banks of the river, with an unlimited supply of ice-cold water, we may go down nearly to 32 dgs. perhaps; but ordinarily we may have to stop at 70 or 80 dgs.

I have carried this out to extremes, to illustrate the principle. The reason why we do not adopt this method of working, is that it don't pay. It costs too much for the apparatus, for the wear and tear, and for the attendance. The nearest approach to this bi-sulphide of carbon engine, is the DR. TROMBLY engine, in which sulphuric ether was used, heated by the exhaust steam. This was introduced in a large steamer running upon the Mediterranean, the water of which was cold enough to condense the ether. It required a good deal of condensing surface, and that is one of the difficulties of this method of working; but he did the work, saved his ether, and used it over and over again, with a considerable increase of power. I presume the difficulty in that case, was the same as in all analogous cases, in making it pay.

We must consider the first cost of the apparatus, the interest upon it, the risk of losing it by wreck or blowing up, or by some chance of business; then we must allow for attendance and repairs; then there is the bulk of the fuel and machinery, and their weight, to be taken into account. That, in a steamer, makes a tremendous drawback in the loss of freight and of passengers. If you carry the principle far enough, you will fill your steamer all up, and its whole business will be paddling along. There has been some efforts to make six-day ships for crossing the Atlantic, sacrificing everything to speed; but they put none of these traps into those ships, I assure you. Although we may get economy of fuel, almost without limit, by duplicating the apparatus in this way, it don't pay.

Dr. VAN DER WEYDE—Another point. In heating water from 212 deg. to about 248 deg., you double the pressure; so that at least 2 deg. are necessary for every pound of additional pressure. But if you heat it to 500 deg., where the pressure is 50 atmospheres, then 15 deg. will produce 15 atmospheres more pressure, or a whole atmosphere for every degree. Here we have to keep the water at 500 deg. and upwards; but there are other liquids that do not require that temperature. Take the liquified carbonic acid gas, which boils at 148 below zero. Heat it to 100 deg. below zero, and you have two atmospheres pressure; an additional atmosphere for about 48 deg. But heat it to 32 deg., and you have 32 atmospheres; and at 50 deg. you have 50 atmospheres, making a whole atmosphere for every degree. It is only necessary then to maintain the ordinary atmospheric temperatures, and in the summer all you have to do is to heat with the atmospheric temperature, and to cool with ice. Your engine will require no coal. But you will have this drawback that melting ice only consumes 140 units of heat, whereas the combustion of coal gives out 14,000 units of heat. For every pound of coal, therefore, you will want 100 lbs. of ice; and ice is not so easy to keep, especially in the summer, as coal. Another difficulty is that the boiler must be strong enough to stand 50 to 65 atmospheres of pressure. Of course, this whole plan is intensely absurd; but as Cicero said that no theory was so absurd that no man would adopt it, so in mechanics, no plan is so absurd that no one will try to carry it out; and there is a young gentleman now endeavoring to carry out this plan. He will have a back pressure of fifty atmospheres on his piston—a very respectable back pressure.

Mr. ROOT—It seems to be the opinion both of Dr. VAN DER WEYDE and of Mr. STETSON, that there is really a gain in using two liquids, one boiling at a lower point than the other. To my mind that is not so. I have drawn here two diagrams of cards taken from the Boston engine. The first cylinder cuts off at half stroke. Now I will agree to take the power thrown away at that first cylinder, and by carrying the expansion up to its limit, obtain all the power that is obtained from the bi-sulphide of carbon, and at a less expense. The same principle will apply in every step, beginning with mercury, if you please. Here is the mercury diagram, expanding right down to the line. That fills a cylinder of a certain size. Exhaust that into another cylinder, and it will require so much the more area. You can go on indefinitely; but you are merely saving the power you have thrown away. I admit that increasing the pressure, the same difference of temperature produces a greater difference of pressure; but we must take into consideration that if we increase the pressure six times we have only one-sixth the volume, and it requires six times as many units of heat to change the temperature; so that when we come to calculate the power of the engine, the effect is the same in both cases. If you expand steam, under a pressure of 60 lbs., the effect will be the same as expanding it in a cylinder of four times the area under a pressure of 15 lbs. It seems to me that the whole thing is explained by the principle stated by Dr. VAN DER WEYDE at the outset of his remarks, that whatever the liquid, it takes the same number of units of heat to make the same volume. Consequently, there cannot possibly be any economy in using different fluids.

Dr. VAN DER WEYDE—The gentleman mixed up latent heat and temperature. The latent heats are alike, but not the temperatures.

Mr. ROOT—You leave out of view the fact that you cannot increase the volume; that you cannot make any more volume with the same amount of heat, from bi-sulphide of carbon than from steam; and unless you can make a great volume, you cannot make a greater pressure.

The PRESIDENT—The Chair understood Dr. VAN DER WEYDE to take the same ground with regard to volume at first.

Dr. VAN DER WEYDE—The latent heat required to change a liquid into vapor, is entirely independent of the temperature at which it boils. Steam at 212 deg. coming in contact with bi-sulphide of carbon, which boils at 110 deg. the bi-sulphide of carbon will flash into vapor. This will condense the steam into water; and 966 units of latent heat will be given out, of which 190 units will be absorbed by every lb. of the bi-sulphide of carbon, and produce some four atmospheres pressure, in exchange for the waste steam without pressure. The advantage is in favor of the bi-sulphide of carbon at every step.

The PRESIDENT—There was an engine brought from Boston some years ago, which gained 50 per cent. by using the hot air in heating steam; and it was suggested that by heating the steam instead of the air, they might gain the other 50 per cent. (Laughter.)

Mr. FISHER—The great difficulty about Dr. TROMBLY'S engine was that they could not prevent leakage, and it interfered with the health of the men.

The PRESIDENT—Ericcson's air ship would not go without a great deal of oil.

Mr. FISHER—I do not believe you can do any more with ether or bi-sulphide of carbon than with the hot water that comes from the condenser. I do not think there is any gain in using the bi-sulphide of carbon.

Mr —— suggested that the application of the principle that artificial draft produces greater economy of fuel, to hot-air engines, would extend their usefulness.

Mr. ROOT—That principle was admitted here, in the former discussion, but I think it is a mistake.

Titaniferous Iron Ores.

THE following letter from Dr. T. STERRY HUNT will be found especially interesting at this time, as the working of titaniferous iron sands is again attracting considerable attention. It is especially valuable on account of the reputation and learning of the writer:

TO THE EDITOR—SIR: The question having been often asked me whether the highly titaniferous iron ores which abound in Canada can be smelted to advantage in the blast furnace, I shall save trouble by making one reply through your columns. I have lately referred such inquiries to what I have written upon the subject and published in the Report of the Geological Survey for 1869. My notes "on Iron and Iron Ores" contained in that volume, are also published in a separate form. I have there shown that iron sands containing as much as 16 per cent. of titanic acid may be successfully treated in the bloomary fire, and made to yield an excellent malleable iron, as is now done by Mr. MOLSON at Moisie. It is, however, a very different matter to smelt massive titaniferous ores in a blast-furnace for the production of pig iron. Many experiments have been made with such ores in Norway, where they abound, and the results as summed up by Mr. DAVID FORBES and given by me in pages 251-253 of the above Report, are as follows: Iron ores become more refractory in proportion as they contain more titanic acid, requiring, if the amount of this impurity be considerable, so much more fuel and flux, "as not to render their employment profitable in a country where other ores free from titanic acid can be obtained at a reasonable rate." It was found that when the ores do not contain over eight per cent. of titanic acid they can be smelted with advantage; but ores holding a larger quantity can only be profitably used when mixed in such proportion with other ores free from titanic acid as to reduce the amount to the above percentage. I have, however, in my report copied a statement to the effect that ores holding 50 per cent. have been smelted in England, using for a ton of iron 2½ tons of ore, 2 tons of coal, and 25 cwt. of basalt and limestone for flux. The metal was said to be of superior quality, as is generally, though not always, the case with that made from these titanic ores. Such ores are necessarily poor in iron; thus, some of the titaniferous ores or ilmenites of Canada hold from 40 to 48 per cent of titanic acid, and only 35 or 40 per cent. of metallic iron, while the rich ores of Hull, of Lake Champlain and Lake Superior, contain from 55 to 65 per cent. Could they, therefore, be readily smelted, with such a large consumption of coal as above, it is not clear that their use would present any advantage.

The progress of investigation since my report was printed does not appear to have changed the aspect of the question. The Iron and Steel Institute of Great Britain, which is an association of all the great ironmasters of the kingdom, publishes a Quarterly Journal, in the number of which for August last, in the Report of the Secretary, Mr. DAVID FORBES, F. R. S., occurs the following paragraph, which I give entire. It will be seen to fully confirm what I have already said on the subject.

"Utilization of Titanic Iron Ores.—The experience of the ironmasters of Sweden, Finland and Norway, where these ores occur in enormous deposits, and where they have been employed in iron smelting for the last century, if not long before, is, notwithstanding the good quality of the iron produced from them, to the effect that they cannot, as a rule, be smelted profitably in a country where fuel is dear, owing to their being so much more infusible, and consequently requiring so much more combustible for their reduction than iron ores which are free, or contain only minute quantities of titanium. For this reason it is that these ores are now no longer smelted alone, but only employed with other less refractory ores, in a relatively small proportion. The attempts made by several English companies to import and smelt in England the Norwegian ores (ilmenite), which are found in immense quantities on the southern coast of Norway, have, up to date, commercially speaking, been failures, nor have the companies connected with New Zealand (Taranaki titaniferous) iron sands been more successful."

T. STERRY HUNT.

Montreal, January 31, 1872.

THE COAL TRADE.

Anthracite Coals.

NEW YORK, March 1, 1872.

WHOLESALE.--The long inactivity, which has been the main feature of the coal market for so many months, seems at last to be yielding a little to the combined influences of cold weather, and a prospect of the approaching opening of navigation. The former cause increases the demand from retail dealers, and the latter seems to have affected to a slight degree the prices at the Scranton sale.

The following are the official returns of the auction sale:

Lump	$3 40	to	$3 42	Average	$3 40½
Steamer	3 77	to	— —	"	3 77
Grate	3 55	to	3 65	"	3 59
Egg	3 52	to	3 70	"	3 61
Stove	4 00	to	4 25	"	4 13
Chestnut	3 50	to	3 55	"	3 53

This is an average advance of a few cents per ton on last months' sale, and it is encouraging as showing that the bottom has been at length reached. The demand for coal at present prices is fair, and the prospects seem good for an active spring trade at low prices.

As will be seen from the annexed circular, the prices of Lehigh coal were not changed at the recent meeting of the Exchange.

NEW YORK LEHIGH COAL EXCHANGE.

NEW YORK, Feb 28, 1872.

At a meeting held this day, the following prices were adopted for March shipments at Elizabethport, Port Johnston and Hoboken.

Lump	$4 75
Broken	4 00
Egg	4 00
Stove	4 50
Chestnut	4 00

E. BELKNAP, Secretary.

Bituminous Coal

Remain precisely as they were last week. Prices are unchanged, and the freights from Baltimore are also the same.

Freights.

The freights from Elizabethport, Port Johnston and Hoboken are falling off from our last quotations. As will be seen by reference to our tables, we quote: Boston $2 25; Providence $1 50; Newport $1 50; Norwich $1 50; Stonington $1 45; Salem $2 22: New Haven $1.

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coa passing over the following routes of transportation for the week ending Feb. 24, 1872, compared with the week ending Feb. 25, 1871.

COMPANIES.	1871. WEEK.	1871. TOTAL.	1872. WEEK.	1872. TOTAL.
*Phila & Reading R.R†	27,424	583,153	72.760	653,785
Schuylkill Canal	....	....	....	....
*Lehigh Valley R. R.	8,419	346,476	54,856	614,121
Lehigh & Sus. R. R.	1,733	58,069	28,209	176,611
Lehigh Canal	....	....	....	....
Scranton North	....	3,521	12,626	98,404
" South	....	137	36,140	294,830
Penn. Coal Co., rail	....	2,761	17,998	139,395
" " " canal	....	....	....	....
Del. & Hud. Canal Co.	....	....	....	....
" " East	....	48,332	10,017	80,434
" " West	....	12,721	8,752	58,867
" " South	....	....	7,835	51,889
Shamokin	14,646	54,087	8,977	48,534
Trevorton	....	....	....	....
Lykens Valley Coal Co.	....	10,046	....	62
Wyoming South	....	....	....	....
Wyoming North	....	....	....	....
P. N. Y. C. & R. R. Co.	....	32,291	4,341	52,399
Williamstown Col'y	....	17 847	....	....
Big Lick Col	....	12,387	....	4,256
Total	52,282	1,181,837	262,511	2,273,517
1870	....	....	52,252	1,181,837
Decrease				
Increase			210,259	1,091,740

* These figures are for the week and fiscal period commencing Nov. 30

† Less coal transported for Co's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending March 24, 1872, compared with week ending March 25, 1871.

COMPANIES.	1871. Week.	1871. Year.	1872 Week.	1872 Year.
C. & O. Canal	....	.....	....	.....
B. & O. R. R.	12,413	84,640	19 886	142,484
H. & B. T. R. R.	4,865	34,526	5,049	41,624
*Harrisburg & D.	7,723	59,724	4,964	115,383
*L. V. R. R.	....	5,484	629	5,431
P. & N.Y.C. & R. Co.	....	30,084	5,704	63,326
Cumberl'd Branch Canal	....	.....	....	.....
" Railroad	....	.....	....	.....
Total	25,001	214,453	36,223	368,248
Decrease			25.001	214,458
Increase			11,222	153,790

The tonnage of the P. & N. Y. C. & R. R. Co. is included in that of the L. V. R..R. Co.

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, February 24, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	28,541	16
" Port Carbon	4,128	17
" Pottsville		
" Schuylkill Haven	15,128	02
" Pine Grove	2,538	17
" Tamaqua	8,560	11
" Harrisburg		
" Dauphin	1,368	09
Total	60,266	12

FOR SHIPMENT BY CANAL.

Passing Frackville Scales		
" Mill Creek "		
" Schuylkill Valley Scales		
" Mt. Carbon "		
" Cressona "		
" Pine Grove "		
" Tamaqua "		
Total		

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	319	00
" Shamokin	5,525	15
" Herndon		
Total	5,844	15

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	815	10
" Lebanon & Pine Grove Branch	627	13
Total	1,443	03

CONSUMED ON LATERALS.

From Frackville Scales	663	19
" Mill Creek "	492	02
" Schuylkill Valley Scales	1,085	04
" Mt. Carbon "	613	10
" Cressona "	378	09
" Pine Grove "	46	05
" Tamaqua "	542	11
Total	3,820	00

LEHIGH AND WYOMING COAL.

Received via Allentown, E. Penn'a Br.	58	19
" " Alburtis, "	12	17
" " Oreland, G. & N. Br.	912	19
" " Connecting R. R.		
" " Willow Street R. R.	400	16
Tota	1,385	11

BITUMINOUS.

From Harrisburg	4,942	17
" Connecting R. R., G. & N. Br.		
" Junction R. R.	21	00
Total	4,963	17

COAL FOR COMPANY'S USE.

Anthracite	2,862	14
Bituminous	333	00
Total	3,195	14

RECAPITULATION

	Total for Week.	Corresp'g week last year.	Increase, and Decrease.
Passing over Main Line and Leb. Val. Branch	60,266 12	13,768 08	i 46,498 04
For Shipment by Canal			
Shipped Westward via Northern Central R. R.	5,844 15	10,285 08	d 4,440 13
Shipped West or South from Pine Grove	1,443 03	953 18	i 489 05
Consumed on Laterals	3,820 00	2,416 11	i 1,403 09
Lehigh and Wyoming Coal	1,385 11		i 1,385 11
Total Anthracite paying freig't	72,760 01	27,424 05	i 45,335 16
Bituminous	4,963 17	7,723 02	d 2,759 05
Total of all kinds paying freig't	77,723 18	35,147 07	i 42,576 11
Coal for Company's use	3,195 14	3,025 04	i 170 10
Total Tonnage for Week	80,919 12	38 172 11	i 42,747 11
Previously this year	738,056 01	645,918 10	i 92,137 91
Total to date	818,975 13	684,091 01	i 134,884 12

SHIPPED BY CANAL.

From Schuylkill Haven			
" Port Clinton			
Total Tonnage per Week			
Previously this year			
Total to date	13,355 16	36,225 17	d 22,870 01

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending Feb. 24, 1872.

	1872. WEEK.	1872. YEAR.	1871. WEEK.	1871. YEAR.
By Railway	17,998 07	139,384 17		2,760 14
" Canal				
Total	17,998 07	139,384 17		2,760 14
Increase 1872		136,624 03		

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending Feb. 24—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872, tons ct	WEEK 1871, tons ct.	YEAR 1872 tons cwt.	YEAR 1871, tons cwt.
Wyoming Region	19920 19	3200 11	149564 05	42776 15
Upper Lehigh Region	3950 16		26183 09	4614 06
Beaver Meadow Region				
Hazleton Region	310 09	39 17	2262 05	744 02
Mahanoy Region				
Trescow Region			5309 03	1043 03
Mauch Chunk Region	10756 04	659 06	35729 08	16523 08
Totals	34938 08	3899 14	219049 10	64701 14
Increase	31038 14		153346 16	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	28209 09	1733 08	176610 13	58088 19
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	1055 16	1995 05	8775 13	6036 00
L. V. R. R. at Packer'n	488 02	171 01	2294 19	1576 5
Delivered to L. & B. R. at Plymouth Bridge	5185 01		31367 05	
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	10756 04	659 06	40048 02	17759 15
W.-B. C. & I. Co.	13835 03	1081 14	105077 04	31940 12
Totals	24591 07	1741 00	145125 06	49709 07
Increase	22850 07		95424 19	
Decrease				

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Feb. 24, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	10,471 13	115,251 06
" Hazleton	40,308 09	390,960 01
" Upper Lehigh	78 05	761 04
" Beaver Meadow	11,625 10	143,718 15
" Mahanoy	2,358 16	47,362 03
" Mauch Chunk	72 12	700 09
Total	65,515 05	703,783 18
Same time last year	9,699 03	396,925 11
Increase	55,816 02	306,858 07
Decrease		
Forwarded East from Mauch Chunk by rail	54,856 03	614,121 08
Same time last year	8,449 00	346,475 17
Increase	46,407 03	267,645 11
Decrease		

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	53,795 10	601,379 19
do East for use L. V. R. R.	1,060 13	12,741 09
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,250 12	14,117 03
To P. & N. Y. R. R.	7,707 09	57,410 06
To N. C. R. R., at Mount Carmel		73 06
To D. H. & W. R. R.	657 12	3,307 11
To L. & S. R. R. at Packerton for rail	313 01	3,265 13
Delivered at M'h Chunk	59 10	482 04
Delivered on line of road above Mauch Chunk	670 19	6,145 15
To L. & S. R. R., at Penn Hav., for railroad		3,766 18
Do. for canal		864 07
To Lehigh Canal Mauch Chunk		99 07
Total	65,515 05	703,753 18

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S. Div. of Central Railroad of New Jersey for the week ending Feb. 17, 1872, and for the year 1872.

	WEEK.	YEAR.
Forwarded East of Mauch Chunk by Rail	15,087	148,401
Delivered at and above do.,	621	7,719
Forwarded East of do., by Canal		
	15,708	156,121
Corresponding period last year—		
Forwarded East of Mauch Chunk by Rail	431	56,355
Delivered at and above do.,	106	4,040
Forwarded East of do., by Canal		
	538	60,396
Increase on Railroad	15,170	95,724
Decrease " "		
Increase on Canal		
Decrease " "		
Of the above there was transported on account of—		
Lehigh Coal Nav. Co	5,573	29,291
Wilkesbarre Coal & Iron Co	6,264	91,242
	11,837	120,533
Corresponding period last year—		
Lehigh Coal Nav. Co	373	17,100
Wilkesbarre Coal & Iron Co		30,858
	373	47,959
Increase	11,463	72,574
Decrease		

Delaware and Hudson Canal Company.

The following is a statement of Coal Transported by the Delaware and Hudson Canal Co. for the week ending Feb. 24, 1872.

	FOR THE WEEK.	FOR THE SEASON.
By Delaware and Hudson Canal,		
By Railroad, East	10,017	80,434
" " West	8,752	58,867
" " South	7,835	51,889
Total Tons	26,604	191,190

For the same period last year.

	FOR THE WEEK	FOR THE SEASON.
By Delaware and Hudson Canal,		
By Railroad, East		48,332
" " West		12,721
" " South		
Total Tons		61,053
Increase		130,137

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Feb. 24, 1872.

	WEEK.	SEASON.
North	46,777 07	366,654 03
South	7,834 13	51,888 12
Total 1872	54,612 00	418,542 15
Corresponding time in 1871:		
North	Suspension.	
South	"	
Total		
Increase North		
Decrease North		
Increase South		
Decrease South		
Total decrease 1872		
Total increase 1872	54,612 00	418,542 15

Huntington and Broad Top R. R. Co.

For week ending Feb. 24, 1872	5,040 tons.
Same time last year	4,865 "
Increase	175 "
Decrease	
Total amount shipped to date	41,624 "
Same time last year	34,526 "
Increase	7,098 "
Decrease	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna and Western R. R., for week ending Feb. 24, 1872 :

	Week. Tons. Cwt.	Year. Tons. Cwt.
Shipped North	12,625 14	98,403 19
Shipped South	36,139 12	294,830 04
Total	48,765 05	393,234 03
For the corresponding time last year:		
Shipped North		
Shipped South		
Total	2,719 18	3,657 12
Increase	46,045 08	389,576 11
Decrease		

Shamokin Coal Trade.

For week ending February 24, 1872	8,976 18
Same time last year	14,646 02
Increase	5,669 04
Decrease	48,833 16
Total amount shipped to date	54,087 09
Same time last year	
Increase	
Decrease	5,553 13

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday Feb. 24, and during the year 1872, compared with the corresponding period of 1871.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To E.&O.R.R. Co Tons Cwt.	Total. Tons. Cwt.
1872	.....	19,886 03	19,886 03
1871	.....	12,413 01	12,413 01
Increase		7,473 02	7,473 02
Decrease			

YEAR.

1872	.....	142,483 19	142,483 19
1871	.....	84,639 15	84,639 15
Increase	.....	57,844 04	57,844 04
Decrease			

Penn. and N. Y. R. R.—Coxton, Pa,

Coal tonnage for week ending February 24, 1872.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received :		
From Lehigh Valley R. R.	7707 09	57,410 07
" Lack. & B. R.R.	1181 19	17,207 07
" Pleasant Valley R. R.	1196 00	23,395 13
" Snl. & Erie R. R.	963 07	11,795 13
Total	12,048 15	109,808 19
Distributed :		
To Lehigh Valley R. R.	160 16	18,110 15
To Lack. & B. R. R.	13 13	528 02
To S. Central R. R.	1229 18	15,378 10
To Ithaka & A. R. R.	5036 16	26,825 05
To Erie R. W. Pockets for shipm't.	3439 03	23,644 01
To individuals on line of road	547 11	8,163 12
To points at & above Carbon for use of Co	610 15	5,565 02
To points between Waverley and Elmira	1010 03	11,594 02
Total	12,048 15	109,808 19
Bituminous :		
Received from Barclay R. R.	5709 11	63,477 09
Shipped South from Towanda	25 00	683 04
Northern Central R. R.		91 01
Total	5734 11	64,251 14
Distributed :		
To Erie R. R.	5291 11	54,131 00
To So. Central R. R.	412 18	9,194 14
To Ithaka & A. R. R.	.....	21 15
To Lehigh Valley R. R.	5 00	650 14
To individuals on line of R R.	25 00	253 11
Total	5734 11	64,251 14

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK. March 1. R. A.	W. A.	AT PHILADELPHIA. March 1. R. A.	W. A.
SCHUYLKILL.				
Lump	$- —	$- —	- —	
Steamer	- —	- —	- —	- —
Broken	- —	- —	- —	
Egg	- —	- —	- —	- —
Stove	- —	- —	- —	- —
Chestnut	- —	- —	- —	
Pea	- —	- —	- —	- —
LEHIGH.				
Lump, (along side)	5 00	——	- —	- —
Broken	4 75	- —	- —	- —
Egg	4 50	- —	- —	- —
Stove	5 25	- —	- —	- —
Chestnut	4 25	- —	- —	- —
Pea	- —	- —	- —	- —
SPECIAL COALS.*				
Honey Brook, Le'h W.A.	4 00@4 75		- —	- —
Spring Mountain " "	- —@- —		- —	- —
Sugar Creek " "	- —@- —		- —	- —
Sugar Loaf " "	- —@- —		- —	- —
Old Compy's " "	4 00@4 75		- —	- —
Room Run " "	4 00@4 75		- —	- —
McNeal " "	- —		- —	- —
Girardville " "	- —		- —	- —
Hill & Harris " "	- —		3 10@4 00	- —
Shamokin " "	- —		- —	- —
Lykens Valley " "	- —		- —	- —
Broad Top " "	- —		- —	- —
McMichael " "	- —		3 25@4 25	- —
Henry Clay " "	- —		- —	- —
Powelton " "	- —		- —	- —

Dealers in these coals may be found in our advertising columns.

Company Coals.

March, 1872.

	L.	Str.	Gra.	Eg.	Sto	Chest
*Scranton at E. Port	3 39	3 77	3 63	4 02	4 10	3 34
*Pittston at Weehawken	4 00	4 00	4 15	4 25	4 50	4 00
*Lackawana at Weehawken	3 75	3 75	3 85	3 85	4 25	3 75
Wilk'b're at Hoboken	3 75	3 75	3 85	3 85	4 25	3 75
Old Co. Lehigh at Pt John'n	4 75	—	4 00	4 00	4 50	4 00
Lehigh at Eliz. Port	4 75	—	4 00	4 00	4 50	4 00

For freights to different points see "Freights.

* To contractors only.

Prices of Gas Coals.

March, 1872.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y.

Duty, $1 25, gold	Coarse	Slack.
Block House	$1 60 @-1 75	
Gowrie	1 60 @-1 75	

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25 @1 25	
Sydney	2 25 @- 80	
Lingan	1 60 @- 80	
Little Glace Bay	1 60 @1 00	
Caledonia	1 60 @- 80	

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal

AMERICAN.

	Currency.
Westmoreland	$7 00 @- —
Fairmount Gas Coal Co. of N. Y.	7 00 @- —
Despard Coal Co.	7 00 @- —
Penn	7 00 @- —
Newburg Orrel Gas	- — @- —
West Fairmount Gas Coal	7 00 @- —

AT PHILADELPHIA.

Powelton	$6 75

TO NEW YORK.

Provincial	
Sidney	$3 25
Lingan	3 25
Cow Bay	37½
Port Caledonia	3 37½
Little Glace Bay	3 25

Prices of Foreign Coals.

March, 1872.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, N. Y.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel	12 00@13 00
" House "	18 00@20 00
" Orrel	14 00@16 00
Per ton 2,240 lbs., ex-ship.	
PRICES FROM YARD.	
Liverpool House Orrel, screened	$16 00@17 50
"Cannel, "	20 00@25 00
Per ton 2,000 lbs. delivered.	

Freights.—March, 1872.

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore.	Anthracite. From Philadelp'a.	Anthracite. From Elizabeth Port, Port Johnston, and Hoboken.	Anthracite. From Newburg.	Anthracite. From Rondout.
Amesbury						
Bangor						
Bath						
Boston		3 85		2 25		
Bridgeport		3 25		1 00		
Bristol						
Derby						
Dighton						
East Cambridge		3 50				
Fall River						
Hackensack		3 25				
Hartford						
Jersey City		2 25		45		
Middletown						
Mystic						
New Bedford		3 50				
Newburyport		4 25				
New Haven		3 25		1 00		
New London		3 25	3 50	1 25		
Newport				1 50		
New York		2 50		50		
Norwalk				1 00		
Norwich				1 50		
Pawtucket						
Portland		4 00		2 00		
Portsmouth, N.H						
Providence		3 25		1 50		
Rockport						
Saco						
Sag Harbor						
Salem		4 00		2 25		
Stamford						
Stonington				1 45		
Taunton						
Warren						
Washington						
TO RIVER PORTS.						
Albany						
Catskill						
Cocksackie						
Coeyman's						
Cold Spring						
Fishkill						
Haverstraw						
Hudson						
New York						
Nyack						
Poughkeepsie						
Rhinebeck						
Rondout						
Saugerties						
Sing Sing						
Stuyvesant						
Tarrytown						
Troy						
West Point						
Yonkers						

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven for consumption	$1 25
For reshipment	

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 64
C. R. R., N. J., Phillipsburgh to Elizabethport	0 95
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$1 94

MAUCH CHUNK TO PORT JOHNSON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 64
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	0 95
Shipping expenses	25
Wharfage	10
Total	$1 94

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Phillipsburgh	64
Morris & Essex R. R. Phillipsburgh to Hoboken	0 95
Shipping expenses	25
Wharfage	10
Total	$1 94

TO SOUTH AMBOY.

L. V. R. R.	72
B. & D. R. R.	91
Cam. & Am. R. R.	
Shipping Expenses	35
Total	$1 08

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	0 75
C. RR. of N. J. Phillipsburgh to Elizabethport	0 95
Shipping expenses	25
Wharfage	10
Total	$ 2 05

MARKET REVIEW.

FOR THE WEEK ENDING MARCH 2, 1872.

IRON.—The market for Scotch pig remains quiet but steady. The stock is not large, and with a fair inquiry for parcels to supply the wants of consumers, prices are firm at the quotations noted in our last—we have only to notice a sale of 150 tons Glengarnock, to go West, at $40.75 cash. American continues to meet with an active inquiry, and prices still have an upward tendency—re-sales have been made of 1,000 tons No. 1 Saucon at $42 ; 1,000 do. No. 1 Crane, $42 ; and 500 do. No. 2 do., $41. Wrought scrap has been in active request, and some considerable transactions are in negotiation. One hundred tons old axles sold at $71 currency. New rails have been rather quiet but are firm, $63a65 gold for English, and $72a74 currency for American, at the works in Pennsylvania. Old are in good demand, and we notice sales of 4,000 tons double-headed, to arrive, on private terms. Refined bar continues very firm at previous quotations for lots as wanted from store. Common black sheets are firm at 5½a6½ cents, and charcoal do. 6½a7 cash. Russia sheet is much firmer, and held for advanced prices, because the shipments of 1872 cannot reach here in time for the fall consumption—sound may be quoted 16 cents, and No. 1 stained 14½a15 gold.

LEAD.—Pig is dull, the Government supplying the limited demand at prices below those generally asked by importers ; sales have been made of 200 tons Spanish at $5.90a5.92½, gold. Bar pipe and sheet are steady at old figures.

COPPER.—The manufactures of copper are firm at 36 cents for new sheathing over 12 oz., and 38 for braziers' and bolts ; bronze and yellow metal sheathing 26, and Y. M. bolts 28, net cash. Ingot is not as active as before, but prices remain quite firm ; the sales embrace about 300,000 lb. Lake Superior at 28⅜a28½ cents cash, mostly at the former figure.

STEEL continues firm and steady at previous quotations, for lots from store.

TIN.—The market for pig remains in the same lifeless state, though there is perhaps a little better feeling among holders, especially of English, consequent upon the receipt of telegrams from London advising an advance there in that description, now quoted £146 ; the last quotation for straits was £140 ; we have only to notice sales of 10 tons English at 35⅜a35½ cents, now generally held at 36, straits nominally 35½a36, and banca 41, all gold. There is less excitement in plates, but no less firmness ; the business is in a measure restricted, owing to the unusual scarcity of desirable sizes of all kinds ; the advanced prices are well sustained, and still have an upward tendency ; sales have been made of 2,500 bxs. assorted charcoal tin, part to arrive, at $11a11.25 for I. C. ; 250 do. charcoal tern, $9.75 ; 250 do. I. C. coke, 14 20, $9.87½, gold ; and 200 bxs. do., on private terms.

SPELTER.—Foreign is very quiet, but stocks are held firmly at 7a7¼ cents gold, for Silesian, as to brand.

ZINC.—The demand is moderate. Am. ox. is held at 7a7½ ; French, 8½a8¾ ; and sheet, 10½a11 ; manganese, 4a4½.

METALS.

NEW YORK, March 2, 1872.

IRON.—Duty: Bars, 1 to 1¼ cents ₱ lb ; Railroad, 70 cents ₱ 100 lbs. ; Boiler and Plate, 1¼ cents ₱ lb ; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₱ lb ; Pig, $7 ₱ ton ; Polished Sheet, 3 cts. ₱ lb ; Galvanized 2½ ; Scrap Cast, $6 ; Scrap Wrought, $8 per ton.

	Store Prices.
Pig, Scotch No. 1, ₱ ton	37 00@42 00
Pig, American, No. 1	42 00@43 00
Pig, American, No. 2	40 00@41 00
Pig, American, Forge	39 00@40 00
Bar Refined, English and American	— —@86 00
Bar Swedes, assorted sizes (gold)	85 00@100 00
	Store Prices, Cash.
Bar, Swedes	115 00@125 00
Bar, Refined, ⅜ to 2 in. rd. & sq. 1 to 6 in. x ¾ to 1 in.	97 50@— —
Bar, Refined, 1¼ to 6 by ¼ & 5:16 & 2½ to 2¾ rnd. sq.	102 50@— —
Bar, Refined, 1 & 1¼ by ¼ & 5:16	105 00@— —
Large Rounds, 3¼ and 3½ inch	— —@107 50
Large Rounds, 3¾ and 4 inch	— —@112 50
Large Rounds, 4¼ and 4½-inch	— —@125 00
Large Rounds, 4¾ and 5-inch	— —@135 00
Scroll	115 00@145 00
Ovals and half-round	112 50@132 50
Band	— —@110 —
Horse Shoe	110 00@120 —
Rods, ¾ to 3-16 inch	102 50@137 50
Hoop	117 50@135 00
Nail rod	7¼@— 00
Sheet, Russia, as to assortment (gold)	16 @ — —
Sheet, Single, D. and T. Common	—5¾@— 6½
Sheet, D. and T. Charcoal	—6½@— 7
Sheet, Galv'd, Nos. 10 to 27	10@13c lb.
" Nos. 28, and 29.	15@19c lb.
Rails, English (gold), ₱ ton	@65 00
Rails, American, at Works in Pa.	@74 00

COPPER.—Duty: Pig, Bar, and Ingot, 5 ; old Copper 4 cents ℔ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ℔ lb	— @— 36
Copper Bolts	— @— 38
Copper Braziers, 16oz. and over	— @— 38
Copper Nails	— @— 42
Copper, Old Sheathing, &c. mixed lots	25½@— 26
Copper, Old, for chemical purposes, 14@16 oz	— @— —
Copper, American Ingot	28¾@— 28½
Yellow Metal, New Sheathing & Bronze	28 @— 26
Yellow Metal Bolts	— @— —
Yellow Metal Nails	— @— 26

LEAD.—Duty: Pig, $2 ℔ 100 lbs.; old Lead, 1½ cents ℔ lb: Pipe and Sheet, 2¼ cents ℔ lb.

Galena. ℔ 100 lbs	$— @— —
Spanish (gold)	5 90 @6 00
German, do.	5 90 @6 00
English do.	5 95 @6 25
Bar.....(net)	9 25 @— —
Pipe.....(net)	— — @10 00
Sheet	— — @10 00

Colwell, Shaw & Willard Tin-Lined Lead Pipe 15 cts. ℔ lb.

STEEL.—Duty: Bars and ingots, valued at 7 cents ℔ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ℔ lb ; over 11 cents, 3½ cents ℔ lb, and 10 ℔ cent ad val.(Store prices.

English Cast (2d and 1st quality) ℔ lb	— 16 @— 18
English Spring (2d and 1st quality)	— 7 @— 10
English Blister (2d and 1st quality)	— 10 @— 17
English Machinery	— 11 @— 13
English German (2d and 1st quality)	— 10½@— 12
American Blister "Black Diamond"	— — @— 12
American, Cast, Tool do.	— 15 @— 16
American, Spring, do.	— 9 @— 11
American Machinery do.	— 9 @— 10
American German, do.	— 9 @— 11

TIN.—Duty: Pig, Bars, and Blocks, 15 ℔ cent. ad val.; Plate and Sheets and Terne Plates, 25 ℔ cent. ; Roofing 25. ad val.

	Gold ℔ lb.
Banca	— @41
Straits	35½@36
English	@36

PLATES.

Fair to Good Brands.	*Gold.*	*Currency.*
I. C. Charcoal, ℔box	$11 25 @11 50	$12 50 @13 00
I.C. Coke	10 00 @10 25	11 25 @11 50
Coke Terne	8 50 @ 9 00	9 62½@10 50
Charcoal Terne	9 75 @10 50	11 00 @12 00

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100 lb

Plates, Foreign.....(gold).....p. 100 lb.	7 00 @ 7 25
Plates, Domestic.....p lb.	— 7 @— 11

ZINC.—Duty : Pig or Block, $1.50 per 100 lb.; Sheet 2½c per lb

Sheet.....per lb.	— 10½@— 11

San Francisco Stock Market.

BY TELEGRAPH.

The following report from the San Francisco Stock Market is dated the 27th inst.; with the exception of a slight advance in Gould & Curry, the list has materially declined. The transactions in the market during the week have been extremely limited, more so than for a long time past. On the 23d inst. sales of Belcher were made at $619, Imperial $105 and Eureka G. V. $16 per share, all of which prices evince a decided decline compared with our last report. A recent San Francisco contemporary states in an annual review of the Pacific Coast Mining interests, that the recent developments on the Comstock Lode, have imparted renewed confidence in its permanency and value and demonstrated it to be the most important ever discovered. The product of the lode last year was $12,500,000, the product for the ensuing year is estimated by many good judges to reach from $16,000,000 to $18,000,000; the total yield of the vein to date amounts to about $130,000,000 an average of $13,000,000 a year. The dividends during the same time amounted to$19,900,300 and the assessments to $7,235,058. Last years' product of the lode was considerably curtailed by the want of sufficient rain which probably accounts for the yield falling below the average of previous years; however, we have only but to refer our readers to our recent quotations of the principal mines in the vein to demonstrate that its value is an established fact.

	Feb. 27.	
Savage	220	—
Yellow Jacket	74½	—
Kentuck	225	—
Chollar Potosi	60	—
Gould & Curry	206	—
Belcher	—	—
Crown Point	220	—
Ophir	—	—
Alpha	—	—
Imperial	—	—
Eureka G. V.	—	—
Meadow Valley	—	—
Amador	—	—
Hale & Norcross	—	—

We are again compelled to omit the reports of the Mining Stock Board. The quotations of Petroleum and Gold Stocks are nominal ; the sales of the board for the week have been confined to Webster, Pet, and Lacrosse gold, the sales of the former named item aggregating 3000 shares at one cent per share, and the latter 500 shares B. 10 at 20c. per share.

Explosions in Coal Mines.

The following letter referring to an article in a previous number of the Journal, explains itself :

CHURCH HILL, TRUMBULL COUNTY, OHIO, February 18, 1872.

TO THE EDITOR : Sir—

In your issue of the 13th inst., there is an editorial notice of the fire-damp explosion at the Henry Colliery, near Pittston, Pennsylvania, in which the cause of the disaster is laid upon the miners. While there are many thoughtless and foolhardy men in the mines who expose themselves and their fellows, even in the face of fore-warned danger, is it not now becoming to be generally regarded by intelligent practical miners and mining engineers, despite the rigid investigations of the French Government, that explosions in mines are caused oftener by want of proper ventilation than by any other cause? If adequate ventilation be provided in a mine an explosion of fire-damp would be impossible of occurrence. If it be a question for the metaphysician rather than the engineer, why miners blow themselves up by exposing their naked lamps in an explosive mixture of fire-damp, is it not equally a question for the engineer rather than the metaphysician, why fire-damp should be permitted to accumulate in mines to the explosive point? ANDREW ROY.

Our correspondent is in the main doubtless correct in his logic. It is not, however, always possible to keep all parts of a colliery so ventilated that sufficient gas will not collect to form an explosive mixture with the air.

GREENWELL, in his treatise on Mine Engineering, says that if from 1-10 to 1-8 of the atmosphere consists of fire-damp, the mixture will be in the highest degree explosive, and he mentions also the fact that sometimes large reservoirs of gas are suddenly tapped, which will foul the air in the air-ways for a considerable distance, even when the ventilating current, as in one instance which he cites, has a velocity of between six and seven feet per second.

The fact is, that though as a general thing the proper attention to ventilation, on the part of the engineer in charge, will protect the men from explosions, the miners themselves have usually been found at fault when the explosions have been investigated.

The cost of proper machinery and suitable air passages may account for the negligence of mine-owners in securing ventilation. Why men love money is in a certain sense, a question for the metaphysician; but why men expose their lives needlessly and recklessly by using unguarded lamps, or opening their safety lamps in dangerous places, is also a question for the metaphysician and, it appears to us, a more subtle one than the former.—[ED.]

The English Metal Market.

The general advance in almost all the metals in the English market had doubtless attracted the attention of many of our readers.

Copper has risen since the end of 1870 more than any other metal.

Iron has advanced thirty per cent., and is still rising.

Our English cousins seem, however, to feel the effect of the stoppage of the negotiations under the Treaty of Washington, where it will be most likely to affect them. A correspondent of the London *Mining Journal* says that the delay thus far has cost Great Britain five million of pounds sterling, by the depreciation of prices, and the retardation of business.

MINING SUMMARY.

Colorado.

THE MAINE LODE.

From the *Miner* of Feb. 8th.

The *Miner* has not made frequent mention of this great true fissure, noble vein of mineral. The reasons for remaining silent no longer exist, and we proceed with pleasure, to lay before our readers a brief description of the mine and its ore yield since its discovery in May, 1871.

The mine, a broad gauge one, with well defined walls, is situated on Sherman mountain, a short distance above the village of Silverplume. The matrix of the vein is feldspathic rock and quartz. The pay vein is argentiferous galena, interspersed with gray copper, ruby silver and iron and copper pyrites. The containing rock is granite. In some portions of the mine there is a solid ore deposit of two feet in breadth. We have frequently examined the Maine and have never seen a barren spot in the mine. Nature seems to have been in a generous mood when she formed the Maine lode.

The question is frequently asked, does mining pay? We answer the question with the following facts and figures.

The yield of the mine since its discovery, about eight months, has been as follows :

Ore treated at Stewart's, 29 tons, 566 lbs., yielded	$ 13,350,32
Shipped to Hill, Black Hawk, 100 tons	19,350.00
Sold to W. Bement, 13 tons	1,509.00
Out at the mine, 80 tons	15,480.00
Total yield of mine	$ 49,689.32
Cost of work done on mine etc.,	11,000.00
Net yield of mine	$ 38,689.32

The above figures we obtained from W. T. REYNOLDS, one of the owners of the mine, and we are satisfied from a personal examination of the records of the mine, that they are substantially correct.

All the above calculations are coin value. The average yield of 222 tons and 596 lbs., total product of mine in eight months, is a little over $223 per ton.

KANSAS LODE.

From the *Herald* of Feb. 14.

Nine claims are being worked on the Kansas, and the lode is producing more gold than at any time during the past six months. The following are the different parties operating on this celebrated vein :

WHEELER & SULLIVAN have done sinking on the First National claim on the Kansas, and have commenced drifting. They are running fifteen stamps of the New York mill on Prize ore, for BUCK & Co., and forty stamps on their Kansas ore.

RICHARDS & Co. are sinking through fine looking ore on the Ophir Company's claim on the Kansas.

IRA EASTERBROOKS, who took the lease of the Mead claim off the hands of WM. LYON & Co., is drifting and stoping in his mine, which presents a better appearance than ever before.

WOLCOTT & Co. are drifting and stoping on the Garrison claim, and taking out good pay.

D. L. SOUTHWORTH is sinking on the next claim east, (WATERMAN'S.)

ROOT is obtaining rich ore and a plenty of it from his claim on the Kansas, near Boston Mill.

On the second claim east of ROOT'S, ANDREWS & SULLIVAN are raising large quantities of fine looking ore, which is being crushed at LAKE'S Mill, on North Clear Creek.

The (English) Kansas Gold Mining Company are making money on their claims purchased some months since of J. F. HARDESTY.

The claim between ROOT, LAKE & ANDREWS is being worked with a windlass.

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Utilization of Coal Dust.

By Mr. E. F. LOISEAU.*

IF means could be provided to reduce the proportion of coal dust or "slack coal," which the preparation of the anthracite for market, by the breaker, produces at every colliery, it would certainly be a great economy in mining coal. I do not doubt that some means could be devised to attain this object. The piling up of coal dust around the mines has become so great a nuisance that some remedy must be found.

If the slack could be converted into an artificial fuel which would be almost equally as good as the anthracite itself, at a very moderate expense, such fuel to be sold a little below the price of anthracite, would it not be the best way of getting rid of the immense accumulations of coal dust existing in the mining regions?

That the coal dust exposed for a number of years to the weather has lost most of its combustible qualities is a fact familiar to all of you. Coal exposed to the weather undergoes a process of slow combustion, taking up oxygen and giving off the volatile products of oxydation. In this decomposition, air and moisture play the principal part, and warmth is the condition promoting it. The degree of heat determines the rapidity of the process. It is therefore evident that an artificial fuel, made entirely from coal dust, which has sustained a long exposure to the weather, can never compete with ordinary anthracite and be sold at the same price; but it is evidently preferable to manufacture an inferior fuel out of the coal dust now piled up around the mines, than to consider said waste entirely useless; and here, allow me to quote a passage from a very interesting letter on the subject, which I received from Lieutenant C. E. DUTTON, of the United States Ordnance Corps. Mr. DUTTON says: "The choice between making an inferior fuel out of the immense deposits of coal dust, and treating the material as dead waste, is certainly very decided, and every economist must look anxiously and with interest to inventions intended to utilize it."

In the manufacture of artificial fuel the inferior quality of the coal dust piled up in the mining regions can be easily remedied, by mixing with it a good proportion of coal dust taken daily from the breakers. This dust, coming from freshly mined anthracite, contains a large quantity of hydrogen, and in this way a good artificial fuel can be made, which will be almost as good as anthracite itself.

All the attempts made in this country to solidify anthracite slack, and make a marketable article out of it have been failures. It is not difficult to account for these failures. Almost every one of the processes used were imitations of what had been done for a number of years in England, in France, in Germany, and in Belgium. The high price of the ingredients used increased the expense so that it could not be applied to bituminous slack, in order to compete with the lump coal. Resinous matters, coal tar and its derivative, solid or fluid pitch, were the materials used as cements; but, although used with success in Europe in the manufacture of artificial fuel from bituminous or semi-bituminous coals, it could never bind together the small particles of anthracite coal dust, so that the lumps would stand the fire, without the use of powerful machinery and a very heavy pressure. A heavy pressure would expel from the coal thus manufactured, the hydrogen which is necessary in fuel to insure perfect combustion, and the lumps would remain in the fire as a dead mass, but partly consumed, in consequence of the adhesion of the ashes. If, on the contrary, the lumps were not consolidated by a heavy pressure, the resinous substances used as cements would be consumed before half of the heating power of the coal had been obtained, and the lumps would disintegrate in the fire.

The use of resinous substances, mixed with the entire mass of coal dust to be agglomerated has many inconveniences besides the cost. It produces, in burning, so much smoke and offensive smell, that it is entirely unfit for domestic purposes. The manufacture of artificial fuel of that kind would also be too expensive, and the product would not compete with ordinary coal.

In Paris (France) an artificial fuel is made for working purposes from charcoal dust, saw-dust, and raw coal tar. This fuel is known as "Charbon de Paris," and is made by submitting the paste to a very heavy pressure, and, to prevent, as far as possible, the bad smell and smoke, the lumps, of cylindrical shape, are baked during twenty-four hours, in ovens, and submitted to almost complete carbonization. This fuel burns very slowly without flame and gives but little heat.

Two years ago an attempt was made to apply that process, or some similar one, to the manufacture of artificial fuel from anthracite coal dust and raw coal tar. A company was organized, and a factory erected at Nesquehoning, Carbon County. Money was freely expended; powerful machinery was erected. The coal manufactured looked well enough; but, being made under a heavy pressure, it could not burn freely. In spite of the baking it would smell and smoke in burning, and the worst of all, the cost of manufacture was too high. It soon became evident to the parties engaged that it would not pay, and the result was a failure. A similar attempt with a similar result had been made a few years ago at Tamaqua.

The only cement which is able to hold the particles of coal dust together, without submitting the lump to a heavy pressure, is common *yellow clay*. This has been known for years, it has been very extensively used in Germany, in Belgium, and in the North of France, and is still in use in those countries. Clay has a peculiarity. It is its excessive contractility at very elevated temperatures. It has the inconvenience of increasing the quantity of ash, and to disintegrate when exposed to moisture. The most eminent mining engineers of Europe agree that clay is the best and the cheapest agglomerant, and also the easiest to be found in the mining regions. Mr. L. GRUNER, chief mining engineer of France, in a very elaborate report, on the manufacture of artificial fuel, made to the Academy of Sciences of Paris, in 1865, says "that clay would undoubtedly supersede all other cements, could the proportion be reduced to a small quantity, and the fuel be made impervious to moisture."

By a process of my invention for manufacturing artificial fuel from either bituminous or anthracite coal dust, I have succeeded in reducing the proportion of clay to seven per cent., and I have no doubt that I will reduce it to five per cent., while by the most improved methods used in Belgium, the proportion of clay is still twenty per cent. The coal manufactured by my process, after being moulded and dried, is dipped, half a ton at a time, in a bath of common benzine, in which rosin No. 3 has been dissolved, the proportion being three gallons of benzine and eighteen pounds of rosin to a ton of coal, the lumps being two cubic inches. The bigger the lump the smaller the quantity of water-proof solution it requires. By exposition to a current of air, the benzine evaporates, and the film of rosin left on the outside surface of the lumps closes so efficiently all the crevices that, according to the report of the Committee on Science and Arts of the Franklin Institute "lumps which had lain in water for *twelve hours* were found to be perfectly dry in the interior when broken up for examination."

I am at present making arrangements by which I hope to be able in a few months to demonstrate by facts that a good and cheap fuel can be made out of the waste coal at a cost far below that of mining coal. This fact, once practically proved, there is no doubt that every colliery of importance will find it more profitable to manufacture artificial fuel out of their waste coal than to continue piling it upon ground which has to be paid for.

* Read, by permission, before the American Institute of Mining Engineers, Feb. 22, 1872.

Experimental Steam Boiler Explosions.

Under this title, Professor R. H. THURSTON, of the Stevens Institute of Technology. has published, in pamphlet form, a report of the trials made last fall at Sandy Hook. The article appeared originally in the *Journal of the Franklin Institute*. The account of the experiments is in the main the same as that of Chief Engineers ISHERWOOD, DE LUCE and ALBERT, which was given in this Journal, of December 26, 1871. Prof. THURSTON makes the following conclusions, which appear to us less comprehensive than those appended to the report previously mentioned. We doubt the correctness of the first conclusion, as it is stated. He says we may conclude—

"*First.* That 'low water,' although undoubtedly one cause, is not the only cause of violent explosions, as is commonly supposed, but that a most violent explosion may occur with a boiler well supplied with water."

With the first part of this statement, we cannot coincide; the latter portion is undoubtedly correct. He proceeds—

"*Second.* That what is generally considered a moderate steam pressure may produce a very violent explosion of a weak boiler, containing a large body of water, and having all its flues well covered."

"*Third.* That a steam boiler may explode under steam, at a pressure less than that which it has successfully withstood at the hydrostatic test."

Danks' Furnace.

At the Cincinnati Railroad Iron Works, on Saturday, November 11, 1871, a rotary puddling furnace was charged with six hundred pounds of Cleveland (England) pig-iron at 7:48 A. M. At 8:45 the cinder was tapped, and at 9:05 the ball of puddled iron, weighing 695 pounds, was extracted. Imported ores were used for fettling on the evening previous. This statement is taken from the published diary of the English Commission, which recently visited this country.

Furnaces in the Lehigh Valley.

Presented to the American Institute of Mining Engineers, February 22d, 1872, by DAVID THOMAS, Esq.

	No. of Furnaces.	Tons per Annum.
Carbon Iron Co., Parryville, Carbon Co.	3	30,000
Lehigh Valley Iron Co., Lehigh Co.	3	30,000
Thomas Iron Co., Hokendaqua	4	52,000
" " " Lockridge	2	20,000
Lehigh Crane Iron Co	6	65,000
Allentown Iron Co	4	36,000
Allentown Rolling Mill Co	2	20.000
Lehigh Iron Co	1	10,000
Bethlehem Iron Co	3	30,000
Colerain Iron Co	1	10,500
Uhler & Do	1	9,000
Glendon Iron Co	5	54,000
Saucon Iron Co	2	18,000
North Penn Iron Co	1	9,000
Total	38	393,500

NOW BUILDING.

Allentown Co	1
Lehigh Iron Co	1
Colerain Iron Co	1
Emaus	1

Besides the foregoing there are along the Morris Canal in Jersey, the following:

Andover (late Cooper & Hewitt	3
Stanhope	2
Boonton (Fuller, Lord & Co	2
Durham on the Delaware	2

The Production of Pig Iron Great Britain.

In the year 1870 there were produced in the United Kingdom nearly six million tons of pig iron: in England, 3,735,000; in Wales, 1,021,000; and in Scotland, 1,206,000 tons. Total, 5,963,000 tons. This is but a slight advance over the product in 1869, which was 5,445,757 tons.

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ROSSITER W. RAYMOND, Ph. D.,
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David Thomas.

THE Council of the American Institute of Mining Engineers, as will be seen from our report of the Philadelphia meeting, has accepted the resignation of Mr. DAVID THOMAS, its esteemed and beloved President since its organization nearly a year ago. Mr. THOMAS accepted the position under protest, sacrificing his own convenience to the good of the cause which he had at heart—the stimulation and consolidation of progress in his profession. His resignation, first offered at the Bethlehem meeting, in August last, he generously consented to withdraw, lest its acceptance might injure the prospects of the young association in the welfare of which he felt so warm an interest. At the Troy meeting in November he was present, to the great pleasure of all, and saw the proofs in that meeting (since amply confirmed at Philadelphia) of the assured vitality and strength of the association. The American Institute of Mining Engineers has indeed sprung into a matured activity not surpassed (if it is fairly equalled) by that of any other scientific or professional society in the country.

But this rapid growth involved an increase of the executive labors and responsibilities, which could not be justly laid upon the shoulders of its venerable President; and Mr. THOMAS once more offered his resignation, solely on the ground of advanced years and infirm health, which scarcely permitted him to attend to his private business. In the letter announcing his determination, he expressed the heartiest sympathy and good wishes for the Institute, of which he "hoped to remain an humble member."

The Council, grateful to Mr. THOMAS for delaying this act so long, felt that there was nothing in the present condition of the Institute to justify a demand for further sacrifice from him, and accepted his resignation with unanimity, though with deep regret. At the same time, they could not allow his hope of continuance in "humble" membership to be fulfilled. We commit no serious breach of secresy in saying, that the proposal of his name as the first honorary member of the Institute was voted with enthusiastic promptness, evoking no discussion except applause; and this proposal was ratified by the unanimous vote of the Institute.

An honorary membership of this body is not an empty distinction. No matter how large the Institute may become, its honorary members are limited to twenty in number. Hitherto, the Council has not agreed upon any name proposed, except that of Mr. THOMAS. A few eminent men—perhaps one or two in each country—will probably in the course of time be added to the list; but there is no hurry. As for Americans, we are in favor of making Mr. THOMAS the only one, as he is the first one, so distinguished. Americans, no matter how eminent or zealous, ought to be active members and associates. Whether our view on this point shall prevail or not, it is certain that the distinction of honorary membership will be charily bestowed. The facts in the career of DAVID THOMAS are too well-known to need recital here in justification of this preference of him by his fellow-members of the Institute. Everybody knows he has worthily won it; we assure him besides that it is something he may be proud to wear.

American Institute of Mining Engineers.

PROCEEDINGS OF THE FOURTH QUARTERLY MEETING, CONCLUDED.

THE Institute met according to programme, on Wednesday evening, the 21st, for its second session, the day having been spent by the members and associates in visits to various points of interest. The large magic lantern of the Franklin Institute was kindly lent for this occasion.

Mr. BENJAMIN S. LYMAN exhibited upon the screen an excellent view of the famous iron column at Delhi, from a photograph which he had brought with him from India. This column has been recently described in the London *Engineer*. Mr. LYMAN having frequently seen it, his statements with regard to it were eagerly listened to by the metallurgists present. He believed the column to be of wrought iron, and suggested that the expression "mixed metal," in the report of the Archæological Surveyor to the Government of India, might refer (if it means anything) to some apparent impurity or imperfect reduction of the iron. The column is 22 feet high above ground, 16.4 inches in diameter at the ground, and 12.05 inches at the top. It is said to extend at least 26 feet below the surface of the ground. The inscription upon it indicates by its Sanscrit characters an antiquity of 1,500 years or more. The popular legend concerning it, that it was driven into the earth by the last ruler of the Hindu dynasty, at the suggestion of his soothsayers, to pierce the serpent who lies coiled beneath the world, is not corroborated by the inscription, which commemorates the glory of one Dhara, of whom nobody now knows anything. It is noteworthy that the popular legend expresses no sense of anything unusual in the material or mode of manufacture. Mr. LYMAN's paper will be published in full.

Mr. COXE remarked that it might have been made by welding blooms, and Mr. LYMAN suggested that the common use of battering-rams in ancient warfare might easily have given a hint for the construction of a rude mechanical hammer. The blooms might have been added at one end only, the rest of the pillar being cold—a process which involves much difficulty in handling, but no obstacle too great to be overcome by abundance of human power and time.

Dr. THOMAS M. DROWN then read a paper, illustrated with diagrams, upon a new machine for testing the strength of metals. This paper we shall publish in full.

Mr. A. L. HOLLEY then commenced the reading of his paper on Rolling Mill Machinery; but, an accident occurring to the lantern, which delayed its operation for half an hour, the reading was suspended, and Mr. R. B. PEARSE, of the Harrisburgh Steel Works, presented a paper on The Manufacture of Iron and Steel Rails. This essay, which will be received with much interest by railway and metallurgical engineers, we shall publish at length. Its most original feature is the assertion of the superiority of the hammer over the rolls for reducing the size of the steel ingot for rails. This is defended on economical and particularly on metallurgical grounds. Mr. PEARSE asserted that rails from hammered steel are more uniform and free from graphite, and adduced experiments at Harrisburgh and in Styria.

Mr. HOLLEY, the reading of whose paper was then resumed, takes ground strongly in opposition to the views of Mr. PEARSE on this point; and the prospect of a debate between these two eminent experts, was highly exciting to the expectations of the audience. Unfortunately the lateness of the hour prevented a discussion, which will doubtless be revived at a future meeting. The substance of Mr. HOLLEY's paper was given by us in a recent issue; and the passage on Hammering *vs.* Rolling (which was not included in the paper as read at the Stevens Institute in Hoboken), will be reported in full in our columns.

THIRD DAY.

The third day of the meeting, being the 22d of February (WASHINGTON'S birthday), and a legal holiday, all shops, manufactories, etc., were closed; and the Institute, relieved from the temptation to adjourn for excursions to such places, devoted the day and evening to papers and discussions, holding sessions at 11 A.M., 3 P.M., and 8 P.M.

MORNING SESSION. After the usual announcements of programme, etc., from the Council, a brief paper by the President, DAVID THOMAS, Esq., was read, in his absence, by Prof. MAYNARD, on the Anthracite Furnaces of the Lehigh Valley. This list, which will be found in another column, is later and more correct in detail than the one presented by Mr. THOMAS at the Troy meeting in November last.

Mr. RAYMOND read a paper on a New Electromagnetic Separator, the invention of Mr. A. H. BALCH, of Baltimore (to be given hereafter in our columns.)

Mr. LYMAN, referring to the statement that machines employing permanent magnets had to be re-magnetized from time to time, thought it would cost more to magnetize every second, as in this apparatus than once in several months.

Prof. MAYNARD said that the attempts to use iron-sand by processes involving "sponging" have never proved commercially successful. The most promising method is one now inaugurating, by which the fine ore is heated with charcoal blaze in a retort, and then worked in the forge by the ordinary bloomary method.

Prof. EGLESTON said foreign governments had spent many hundred thousand dollars in some of these

processes, and failure only had resulted.

Mr. J. BLODGETT BRITTON said he had suggested to ironmasters to make such iron-sands into mortar with lime or clay.

Prof. EGLESTON—That was tried in New Zealand and failed. Up to this time the only successful method has been that of the low furnace.

Mr. BRITTON—The New Zealand sands were titaniferous. I refer to pure magnetic sands. The mixture with lime or clay has been found practicable for hematites, and I should think it ought to work with magnetites.

Prof. EGLESTON—I think experiments of the kind, tried with iron sands subjected to magnetic separation were unsuccessful. Hematites present quite different conditions. Brown hematites frequently occur, already mixed with much earth or clay. In Silesia ores are extensively used, that will grow potatoes very well. They contain only 26 per cent. of iron. In Sweden, where the metallurgical practice is excellent, ore is employed in pieces no larger than a pea. Doubtless a certain proportion of fine ore can be admitted in the blast furnace.

Prof. MAYNARD—A considerable proportion of the Champlain ores gets broken off in handling; and this fine stuff must be used in the furnaces, as it has been paid for. It is added to the charges, and can be reduced (not without occasional inconvenience in the hearth) with the rest.

The next paper was by Mr. S. H. DADDOW, on Pillars of Coal. (To be published in full next week.)

Mr. COXE remarked that at Blanzy the old, so-called Blanzy method of exploitation has been abandoned, and a new system introduced, the peculiarity of which is the filling up of the excavated spaces with rock from outside the mine, carried in for this purpose. The cheapness with which this can be done in that locality is surprising. The steep, thick bed is worked out in layers from the footwall, each new layer having the rock-packing as a foot-wall. With regard to comparison of the safety to life of different systems, he remarked, that the ordinary tables of casualities are scarcely a fair basis. What is needed is a carefully prepared table, from which all accidents are omitted that are not in some way connected with the system pursued. Men run over by cars or falling down shafts, or in any way injured by reason of their own carelessness or that of their employers, should not be counted in such a comparison, unless the system of working involves the cause of accident, or renders it more likely to occur. Mr. COXE then sketched the system employed in the Königshütte mine (Silesia) which produces 3,500 tons of coal daily, extracting, by a system of chess-board chambers, nearly or quite all the coal. Among the difficulties in American mining, the first is the inadequacy of capital, to lay out the work properly. Again, our miners are not miners. Many of them barely know enough to make a hole, put powder in it and fire it, without killing themselves. It is difficult to make them accept, or understand, to say nothing of efficiently carrying out, any but the rudest system. Another difficulty in the way of abolishing the pillar system is the fact that in the Lehigh region the overlying rock to many veins is exceedingly hard. In some cases, several acres of it will stand after excavation, refusing to fall for a long time, and then come down all at once.

Mr. DADDOW admitted that in such cases there is a special objection to long-wall or any other method depending upon a speedy and controllable fall of the roof, but claimed that such hard roofs occur but seldom in our coal-fields. With regard to the filling with outside rock at Blanzy, possibly the fear of breaking the soft coal by other systems may have had something to do with it.

Mr. RAYMOND described the *Bruchbau* followed in Zwickau (Saxony)—a species of long-wall retreating, which requires large capital to lay out the field in advance, but presents the maximum of production, safety, convenience and economy. The settling of the surface, due to this method of mining, has not been found to cause much damage. It is in most cases imperceptible, though now and then a chimney or brick-wall shows it.

Mr. CORYELL—Such settling is usually gradual, and at all events it does not permanently disfigure the surface. The Baltimore Co. worked a 20-ft. vein, the roof of which went down some twenty years ago; and to-day the depression is scarcely noticeable. It is hard to find the spot. He corroborated what had been said of the prevalent ignorance of the miners.

Prof. EGLESTON—Are we not to blame somewhat for the lack of instruction among the miners? Why should not the Institute take this subject in hand. He instanced the *Bergschulen* of Germany, where common miners were trained and made capable of promotion.

Mr. COXE thought enough should be taught in the common schools, at least to show a man that carbonic acid would kill him, and why he must not drive an iron rammer into a hole full of naked powder.

Mr. RAYMOND thought the miners' leagues should pay some attention to the mutual improvement of their members. These associations could accomplish much, if they would not ignore the fact that intelligence and skill afford the best protection to labor. Whether this Institute takes the matter up or not, each member of it can do his duty in enlightening his subordinates, as he has opportunity. One member (Mr. COXE) is already setting a good example, by lectures etc. among the men employed at his colliery.

Mr. SYMONS said the British School of Mines is doing something in this direction by lectures among the working miners.

AFTERNOON SESSION. Vice President COXE took the chair, and after calling the Institute to order, announced that the Council had received with regret from Mr. DAVID THOMAS, a letter renewing his resignation of the Presidency, on account of advanced age and infirm health. [Mr. THOMAS had offered his resignation for the same reason at the Bethlehem meeting in August, but was then persuaded to withdraw it.] In accepting this resignation, the Council unanimously resolved to propose Mr. DAVID THOMAS to the Institute for election as its first honorary member.

Mr. THOMAS was thereupon unanimously elected an honorary member of the Institute.

Mr. COXE then announced that the Council had appointed R. W. RAYMOND to fill the vacancy created by the resignation of Mr. THOMAS, R. P. ROTHWELL as Vice-President, to fill the vacancy caused by the appointment of Mr. RAYMOND as President, and Prof. J. P. LESLEY as Manager, to fill the vacancy caused by the appointment of Mr. ROTHWELL as Vice-President. Mr. RAYMOND then took the chair, and the following names recommended by the Council were unanimously elected as members and associates:

(*m*) F. C. KRAUPFF, Philadelphia.
(*a*) E. R. BIDDLE, New York.
(*m*) Prof. J. S. NEWBERRY, New York.

By invitation of the Council, Mr. LOISEAU read a paper on The Utilization of Coal-dust as Fuel, which will be found in another column.

Mr. BLANDY gave an account of the experiments at Tamaqua, the failure of which was due to causes not really inherent in the process—chiefly to bad machinery and bad management. While Mr. GAUJOT and himself, for a short time, run the works at Tamaqua, they made good fuel, cheaper at that time by 50 cents per ton than coal. They managed the establishment without remuneration, to demonstrate the feasibility of the enterprise. In a small way (4 to 5 tons daily) the product was sold at a profit, and gave satisfaction. The material used with the dust was coal-tar. If well dried, it gave no smell in burning. He burned a ton or two in his own house. He withdrew from the concern upon the appointment of a Superintendent, who, in trying to double the production with the same plant, ran the machine all to pieces. The same person afterwards persuaded parties in Philadelphia to build the Nesquehoning works, which also failed. Mr. BLANDY could not say whether on a large scale the coal-tar process would, at present prices, commercially succeed. A great demand for coal-tar would raise the price of that material. At all events, the works should be where coal-tar could be abundantly and cheaply obtained.

Mr. COXE asked whether the samples of Mr. LOISEAU's fuel tested in Philadelphia were made by hand or by machinery.

Mr. LOISEAU—By hand. I have seen the poor people in Belgium buying the coal slack, and balling it by hand with clay for fuel. This coal was a sort of anthracite. A manufactory in Belgium makes by machinery 490 tons daily, with 20 per cent. clay. But it cannot stand the weather. I tried to reduce the proportion of clay, and to make the fuel water-tight. For the latter purpose I have found rosin and benzine the cheapest materials. The Nesquehoning works, alluded to, with their expensive plant could only make (of the coal-tar fuel) 15 tons per day.

Mr. BLANDY said there was nothing new in the coal tar patent except the use of anthracite dust instead of bituminous, which had been so treated abroad.

Professor EGLESTON questioned the statement that the Belgian coal was a sort of anthracite, and said that the process with clay, etc., was used as long ago as 1810 in the North of France.

Mr. LOISEAU said he did not claim anything new, except the water-proof coating and some peculiarities of manufacture. The use of clay dates from 1789.

The next paper was read by Major T. B. BROOKS, on "The Methods of Extraction Employed in the Iron Mines of Lake Superior," to be published in full in our columns.

Mr. BLANDY remarked that a good deal of the dead work is represented by second-class ore (less than 65 per cent. of iron) now cast aside, but which will be valuable some day.

Professor MAYNARD inquired whether there is any guarantee of 65 per cent. iron in the ore to purchasers.

Major BROOOKS—There is no guarantee, but that is the average. A variation of one or two per cent. either way is not complained of. If we could use our lower grades, the cost of iron on the car would be reduced, perhaps, 55 cents.

Professor MAYNARD—The lack of a guarantee is a great evil here in the East. For instance, we get on the Hudson river brown hematites from Harlem valley, containing nominally 40 to 45 per cent., and costing $5 30 to $6 40 per ton. But some of these ores yielded last year at Mr. Griswold's furnace only 25 per cent., though they cost $6. In cold weather the ore from Harlem valley is very badly cleaned, as the ocher and ore freeze together. Yet it costs the purchaser just as much.

Professor EGLESTON—The value of ore should be determined, as it is in Europe for all metals, by a formula. Ten years ago this would have been impracticable, for lack of chemists. Now it could probably be done.

Professor MAYNARD—A few months ago the furnace owners of the Hudson river did not dare to complain or dictate to the Harlem valley mine-owners, upon whom they thought they utterly depended for a necessary material. Now it is all changed. We can get at Hudson, St. Lawrence County, 50 per cent. hematites at $7 38, and the Wayne County ores are put down at Albany for $5. The day of the commercial despotism of the brown hematites is past.

Mr. RAYMOND remarked that Major Brooks' paper, in its complete and thorough analysis of mining costs, and its recognition of the great truth that a mine is constantly destroying its own capital, offered a very good model for the study and imitation of engineers.

The question of the cash value of a producing

mine is one of capitalizing an annuity of limited period, and yet many persons seem to suppose that a rough estimate of costs and profits, guessing at everything, and then dividing by 2, "to be perfectly safe," and a simple calculation of a sum upon which 10 per cent. dividends could be paid out of the profits so determined, constitute a reliable determination of value. The error is almost universal of valuing a mine according to the amount it has produced. In fact, the ordinary mining risk is such as fairly to require 40 per cent. annual profit in the far West, and 30 per cent. in the East. If a mine is not doing as well as that the stock ought not to be worth par. Exceptions may be made in cases where the assured prospect for the future is so much better as to influence the value of the stock, or where much of the mining risk is removed, as in the case of coal mines on regular beds in well-known basins. Here the exact extent and duration of the deposit and its gross and net value, can be reasonably determined beforehand. But it is remarkable that coal and iron mines, the value of which can be closely ascertained, sell, on the whole, cheaply, while gold and silver mines, on which the discount for risks should be larger, are generally held at inflated prices. The favorable "general opinions" of experts are used to bolster up these high valuations. Engineers ought to discourage this, and to insist that their opinions shall not be so misused.

Professor THOMAS EGLESTON then read a paper on "The Utilization of Blast Furnace Slags," which we shall publish hereafter.

EVENING SESSION.

MR. JOHN FRITZ, of Bethlehem, being recommended by the Council, was elected a member of the Institute. The following resolution, recommended by the Council, was unanimously adopted :—

Resolved: That the thanks of the Institute are hereby presented to the University of Pennsylvania, for its tender of a hall for our sessions ; to the owners of metallurgical and mechanical works, who have so cordially received our visits, and to the very efficient Local Committee, to whose zeal and tact the success of this pleasant meeting has been largely due.

Major T. B. BROOKS then read a paper on exploring for iron ore, followed by some remarks on the use of the magnetic needle in prospecting and geological work. In this paper, which will be published in full, he gave several practical ways of testing roughly in the field the quality of an iron deposit, applicable chiefly in the Lake Superior region, where the purity of the ore makes the per-centage of iron an unconditional measure of value. Explorations of the extent of a deposit have to be done with pits and by stripping. In the mines, but not in prospecting in the woods, the diamond drill has been used. Concerning the employment of the dip-needle, Maj. BROOKS made some interesting observations. He showed how in crossing a deposit running E. and W., the needle will twice come to a vertical position—once when it is directly over the deposit, and again at some distance north of the deposit, where the local magnetism and terrestrial magnetism equilibrate each other. This leads beginners to error in the use of the needle ; it is necessary to observe the intensity of the attraction at the two points, as shown by the rapidity of its vibrations. This is much greater immediately over the deposit. The significance of the intensity in magnetic explorations is indeed very great, greater perhaps than that of the inclination taken alone. The horizontal needle is not so much affected by E. and W. as by N. and S. deposits, *i.e.* the effects are not so easily interpreted. The distance at which local magnetism may affect the needle, is sometimes very great. He has observed it as far as 2,500 feet ; and it is reported in Sweden as far as two miles, which seems incredible. Maj. BROOKS concluded by briefly hinting the use of the needle in plotting geological work in Michigan, by taking advantage of the magnetism of the Huronean rocks. He exhibited a large and beautiful chart, illustrating this principle.

Prof. EGLESTON thought the Diamond Drill Co. was now making hand drills for prospecting.

Mr. COXE said the manufacture of such drills had been discontinued, but agreed with Prof. EGLESTON that the diamond drill, driven by steam or compressed air, is working a revolution in mine-explorations. A case recently occurred at the Bare Ridge colliery in Pennsylvania, in which the diamond drill, at great saving of time and cost, had bored a horizontal hole 275 feet, taking out a core all the way, and demonstrated the true position of a coal-bed, which it was necessary to know in order to properly continue the underground work.

Mr. RAYMOND referred to the treatise on Mining machinery by Prof. W. P. BLAKE, in the U. S. Report of Mining Statistics of 1870, for similar instances, and for the prophecy of the great usefulness of the diamond drill in this direction. With regard to the magnetism of bodies of ore, he inquired whether this had been found to bear an invariable relation to the points of the compass, or the position of such masses in the earth—in other words, to the direction of the terrestrial currents.

Major BROOKS said that ninety-nine times in a hundred the upper end of the deposit is south-magnetic, like the north pole of the earth—that is, it attracts the north pole of the magnetic needles.

Mr. RAYMOND described a curious magnetic fissure vein observed by Mr. A. EILERS several years ago, on Saint Ignace Island, off Nepigon Bay, on the north coast of Lake Superior. The vein is vertical, about a foot wide, and visible in the face of a high cliff. It attracted the needle at the distance of a mile. The vein-filling is apparently an impure, slaty iron ore, poor in iron, laminated horizontally across the fissure (at right angles to the walls). Its magnetism is intense, and polar in a line perpendicular to the laminations. From a specimen in his possession, he thought these cleavages were not joints, but regular planes of deposition. The laminæ are pretty regularly one-sixteenth of an inch thick, and occur throughout the whole mass. The vertical position of the fissure, and the absence of all crystallization in the vein-stuff, leave no room for a theory of pressure sufficient to produce joints, even if these resembled joints, as they do not. The country rock is trap.

The next paper was by Mr. S. H. DADDOW, on Blast Furnace Fuel. It will be published in full, and refers principally to bed B of the Pennsylvania coal measures, which is identified through West Virginia, Ohio, Illinois, Kentucky, etc. This identification was attacked by Mr. RAYMOND, on the ground that such generalizations are unsound in principle, in the absence of positive and continuous stratigraphical evidence; and that in this case the evidence of every kind is fragmentary and dubious. Mr. DADDOW briefly replied, maintaining his conclusions as based upon extensive personal observation.

The closing paper was read by Mr. B. S. LYMAN, on Surveying in Geological Work (to be published in full). He exhibited specimens of maps, in which the contour, not only of the surface, but also of one or more underlying strata, was indicated by contour curves. Prof. J. P. LESLEY was mentioned as the one to whom is due the credit of introducing into this country the principle of careful surveying and topographical mapping in field geology.

Mr. CORYELL remarked that he surveyed the Hazelton mines in 1842 under instructions from Prof. LESLEY. In that case, the surface was colored green, the underground work (coal-beds) black, and the water blue.

Prof. MAYNARD said the Swedish survey is represented in colors on a similar principle, the maps being very handsome.

Maj. BROOKS spoke of the excellent chart of colors issued by the British survey, and thought if colors were used, it would be well to follow that well-digested classification, for the sake of uniformity. He referred to Mr. BLANDY'S paper on the topography of the Portage Lake region (read at the Bethlehem meeting of the Institute) as highly suggestive and valuable, and united with preceding speakers in giving the highest praise to Prof. LESLEY'S little book on Coal and Its Topography, as the most useful manual on the s u

Mr. LYMAN said the objection to the use of colors is that they cannot be cheaply reproduced in printing. For ordinary maps, to be photolithographed or engraved, it is necessary to use broken and dotted lines etc., to denote the differences otherwise shown in colors.

At the close of the discussion, the President briefly congratulated the Institute upon the unmistakable success of its first four quarterly meetings. The character of the papers presented, the vigor and good temper of the discussions, and the great social enjoyment and professional profit which all have derived from the meetings, have been so many pledges of the future prosperity of the Institute. No one has been urged to join the Institute ; its doors are open to the profession and to the public interested in its objects ; but it is not a beggar for members or associates. Assured in its vitality and progress, it is assured also in the expectation that the mining engineers and metallurgists of the country will gather around it, not for its sake, but for their own.

The Institute then adjourned, to meet again in May, at such place as shall be announced by the Council.

About-town Jottings.

The work of strengthening the posts upon which the elevated railroad on Greenwich street rests, has just been completed, and the cars are again making regular trips.

On Mondays, Wednesdays and Saturdays of each week, a car is run through the completed portion of Beach's tunnel, under Broadway, for the accomodation of visitors.

BUSINESS AND PERSONAL.

Attention is called to the advertisement of DANAS & COMPANY, formerly DANAS & LITCHFIELD, 18 William street, on our outside page.

Personal announcements and business notices, inserted in this column, at fifty cents per line.

Geo. F. Blake & Co., 79 Liberty street, Steam Pumps of every size and capacity, for all purposes.

Utica Steam Engine Co. (formerly Wood & Mann Steam Engine Co.,) 42 Cortlandt street, N. Y.

Post & Goddard have removed to No. 111 Liberty street. Dealers in Taps, Dies, Reamers, Drills and supplies generally.

Peteler Portable R. R. Tracks and Cars. Miners and contractors, send for circulars, 42 Broadway, N. Y.

American Submerged Pump. Power attachment—cheapest and best in the market, 55 Chambers street, N. Y.

Roper Caloric or Hot Air Engine, 124 Chambers St.

Blake Bros., New Haven, Conn., manufacture Stone Breaker for crushing ores and minerals of every kind into small fragments, preparatory to their further comminution by other machinery.

Chas. S. Parker is the only special advertising agent connected with the "Journal."

Polytechnic Association of the American Institute.

Meeting held February 16, 1872, President TILLMAN in the chair.

BLOWING OFF STEAM.

Mr. FISHER inquired how much water would be blown off with the steam from a Field boiler.

Dr. VAN DER WEYDE—You may blow the boiler empty.

Mr. STETSON—It is a question of time. If you blow off rapidly, the steam mixed with the water will throw the water out, and that is what takes place in an explosion. If you blow off slowly, you will leave the boiler nearly full.

Mr. FISHER—If the steam is at 370 degrees, the water itself would contain heat enough to evaporate about one-seventh of the water, when the pressure is removed. But will not some of the water be blown

off with the steam in the shape of foam, and how much?

Mr. ROOT—I have seen it done a number of times, and I have never seen over 25 per cent. of the water blown off under the best circumstances.

Dr. VAN DER WEYDE—At 350 degrees you have 138 degrees surplus of heat in the water. Dividing 966 degrees by this number shows that exactly one-seventh is evaporated.

STEAM BOILER EXPLOSIONS.

Dr. VAN DER WEYDE—I wish to report a curious attempt at a boiler explosion that took place at Williamsburg yesterday at the new gashouse. The workmen were alarmed by a shock in one of the upright tubular boilers, and they at once stopped work and drew the fire. It was a very high boiler, with interior vertical tubes, surmounted by a dome. The water stood around the tubes and the fire passed through them. They found, on examination, that several of the tubes had sunk down, making a depression both at the top and the bottom; but there was no leak. Now, what was the cause of that? I ascribed it to scale, which had formed at the bottom and allowed the iron to become very hot and soft, and, probably, the weight of the water forced it down, drawing down the crown sheet with it.

Mr. ROOT—If there was scale deposited upon the bottom of that boiler, allowing the lower part of the bottom plate to be heated 50 to 100 degrees hotter than the upper side, that difference of temperature would cause it to bulge down.

A discussion of the merits of Ellis' bi-sulphide of carbon engine, which will be found elsewhere, was next in order.

SEPARATING COCKLES FROM WHEAT.

Mr. HENRY, of Tennessee, described a new apparatus by means of which cockles are separated from wheat. There are two cylindrical rollers, about eight inches in diameter, one of which is of iron and the other of vulcanized rubber. The cockle, being a rough grain, imbeds itself in the rubber, and is carried over and swept off. The cockle is of as large diameter as the wheat, and it has hitherto been difficult to separate it. It poisons hogs and poultry, and no use has been found for it after it is separated from the wheat.

DANKS' PUDDLING FURNACE.

Mr. SAMUEL DANKS explained his new puddling furnace, which substitutes steam for man power. He had conceived the idea in 1856, and in 1857 was nearly ready to start, when the financial crash stopped his operations. He has recently carried the plan into successful operation. The iron is placed in a hollow cylinder, hung and revolving upon an axis at right angles to its central line, so that the melted metal is thrown from end to end at each half revolution. By this process, five tons can be as readily puddled at once by steam power as 500 lbs. could formerly by hand. The result is shown at Chattanooga to be the removal of impurities more perfectly than ordinary puddling. The phosphorus is entirely removed by the new process. The iron may be heated to a higher temperature than it can be worked at in hand puddling. The furnace is lined with the oxide of iron, and instead of losing 15 to 20 per cent. by the process, it is found that there is actually a gain of 7 to 10 per cent. Ordinarily, we can make 2 to 2½ tons before re-lining.

Dr. VAN DER WEYDE—I was not aware until to-night that the oxide of iron was used for the lining. That is a most beautiful method, for the oxide of iron is itself partly reduced, and there is a gain instead of a loss in the charge.

Mr. FISHER—How large a mass of iron can you make, to roll into a boiler plate, for example?

Mr. DANKS—There is scarcely a limit to the size of the puddled ball. It depends upon the apparatus for reducing the lump. The iron is more perfectly puddled than it possibly can be by man power.

Dr. VAN DER WEYDE—I suppose it is as homogeneous as Bessemer steel.

Mr. DANKS—A puddled ball is always homogeneous and crystalline. The fibre is due to the elongation of the crystals by rolling and hammering. If you wish to retain a portion of the carbon, you can stop the puddling process at any stage you choose, and then you will have steel, and that will remain steel, without showing fibre, through a great number of workings. Or we can make the finest quality of iron. We can make an iron that will bear a tensile strain of 70,000 lbs., when the same material treated in the ordinary furnace will not bear more than 50,000 lbs., for the simple reason that the puddling is more complete. In the old hand process, the iron was liable to have faults, and it was necessary, therefore, to weld several bars together to make it homogeneous. In this that is unnecessary.

The PRESIDENT—What is the cost of the puddling, as compared with the hand process?

Mr. DANKS—It is about one-half, depending upon the quantity produced. It takes about the same number of men to man the furnace, but the labor is less. It will bring another class of men into the puddling field, for I have not found many of the old puddlers of any use. I have found that a good man from the machine shop would make a better puddler than the old puddlers, for the reason that the latter will stick to the old ideas.

Mr. STETSON—In making balls of seven or eight hundred pounds weight, how much does the whole revolving mass weigh, charge and all?

Mr. DANKS—The cylinder is about six feet in diameter on the outside and four and a half feet long. The whole weighs about five tons. We have a pair of engines for each furnace. Several velocities are necessary, and also a reverse. The axis rests upon four rollers, so that the friction is not very great. When we are refining, a slow motion is necessary.

The PRESIDENT—Have you built any in England?

Mr. DANKS—The iron and steel manufacturers sent a Commission, who brought about 60 tons of material, and have tested the process and have made a favorable report.

MUSICAL INTONATION.

The PRESIDENT (S. D. Tillman) read a paper on true musical intonation, pointing out the mode of avoiding the imperfection of the chords resulting from the tempered scale of twelve semi-tones, by tuning a larger number of perfect fifths; but suggesting the query whether a true musical taste will sanction changes of a comma (one-fifth of a semitone), resulting from the introduction of the grave second with the subordinate, and the grave fourth with the dominant.

Dr. VAN DER WEYDE demonstrated mathematically that the interval between the second and the sixth of the diatonic scale, if perfectly tuned, is less than a fifth, and, therefore, not a chord.

Adjourned.

Systematic Preparation of Mineralized Ores by Dry Crushing and Concentration.

VI.

INSTEAD of entering into a minute description of the apparatus used for dry concentration, which would not be readily comprehended without diagrams, the following synthetical statement is presented.

I. The machine consists of a portable frame of iron 5 feet in length, 2 feet in width and 3 feet 10 inches high, weighing 1000 lbs.

II. The operating mechanism within, consists of

a) an adjustable feed hopper—

b) an ore bed of wire gauze tubing, permeable to puffs of air readily—

c) a roller beneath the ore-bed for the support of the column of concentrated stuff gravitating downwards and for the discharge of the same at a regulated speed—

d) a bellows or intermitting blast apparatus for delivering puffs of air through the ore-bed so as to lift, agitate and float upward, intermittingly, the lightest patts of the ore and to cause such matter to overflow from the surface of the ore itself, whilst the heavier metallic particles are permitted to gravitate downwards to the roller provided for their discharge as regulated.

III. As a whole this machine is a compact combination of adjustable and automatic mechanism by means of which a given quantity of ore is lifted in air intermittingly and so agitated by air as to effect the separation of the heavier from the lighter parts, by allowing the particles to move in obedience to their own weight or gravity, the latter overflowing from the surface and the former sinking between the gauze tubing to the discharging roller.

All metallurgists familiar with the dressing of the valuable ores by water machinery are aware of the difficulties attending the selection of a location suited in quantity, quality and regularity of water supply. As already stated, in these papers, the devices for ore dressing by water have been pushed to great success, but aside from the difficulties, just alluded to, the actual working of these devices is necessarily accompanied with unavoidable discomforts and in some climates subject to absolute obstructions. Theoretically and away from the works, a specimen sample presents an inviting system to the imagination, which is, however, not borne out in practice. In addition to these drawbacks the cost of plant for large works, as well as the cost per ton, is so considerable that a seperate company organization for the purchase and dressing of the ores is made essential. Consequently, the erection of such works has been delayed in all the mining districts of the United States to the infinite loss of the country, and the ruin of many individual enterprises which would have been a success with the aid of an easily obtained means of concentration.

Dressing ores by the employment of air is not new, at least, experimentally. Many attempts have been made in Europe as well as here, to produce good and reliable results with air in preference to water, the difficulty lying in the fact, that delicate and exact mechanism was required when using the former to accomplish what the water would do by means of very much simpler contrivances. It is not asserted that all of these attempts were failures, perhaps, on the contrary it should be said, that they illustrated the difficulties, and each one was a step in advance. The dry ore concentrator, perfected by Mr. KROM, is the only one known to the writer which has been practically worked on tons of ore continuously and satisfactorily for months, in any mining district. There is warrant, therefore, for claiming a success in favor of this machine, sufficient at least to justify the proposed system of ore preparation, and the employment of this machine for the purpose intended. In regard to the working of this device, the following language of the inventor is copied.

"There are but a few principles on which all the plans for mechanical separation of ores are based; that of a free fall of the ore in a steady moving current of water or of air, centrifugal force or analogous throwing of the crushed material freely through air at rest, and intermittent impulses of jets of air or water. The first two are alike in their effect, and produce deposits together of equally falling grains. But this is not the separation required. Owing to the various shapes of the ore particles, practical and useful separation cannot be effected by these means.

As a general approximation, crushed ore particles differing greatly in shape, may be proportioned in three main classes, as follows:

1. Roundish grains, about.....50 per cent.
2. Oblong " " .....25 per cent.
3. Flat-shaped " .....25 per cent.

The manner in which the flat, oblong, and highly angular grains happen to be presented to the action of the air, as when thrown from a centrifugal machine, influence the length of time of their falling.

A flat-shaped grain of gangue rock—for instance, if its edge cuts the air—will be thrown and deposited with the heavy mineral; and the flat-shaped heavy mineral will be deposited with the light gangue, if its flat or broadest side should be presented to the resisting action of the air.

The intermittent action of air or water involves a further and superior principle; and, as between these two, air is far preferable. Jets of compressed air thrown up through the ore or bed of material, in rapid succession, have the effect to lift the lighter portion to the top, and allow the heavier to sink to the bottom, and almost irrespectively of the varying sizes and shapes of the ore particles or grains.

The more sharply or distinctly these jets of air are given, the more perfect and well-defined will be the separation, and the greater may be the varying sizes of the grains. And the more rapidly in succession are the jets of air repeated, the greater will be the amount of work done in a given time.

The Krom machine gives both sharpness of effect and rapidity of succession in the air jets. It is essential in concentrating by means of either air or water, that time should be allowed between the successive upward thrusts or lifts, for the whole, in each case, to come to rest, or very nearly so, before the next lift is applied. But the freedom with which ore particles fall in air, and the very slight extent to which each lift of the material is carried, allow the lifts to be repeated tn these machines 400 or 500 times per minute, while water would admit only about 100 per minute. In short, by the use of air, properly applied, greater perfection of concentration is obtained, and the amount done is greatly increased, the amount of material treated depending almost solely on the number of lifts which can be applied within a given time.

The next paper will be devoted to examples of concentration and conclude the series.

G. W. BAKER.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. It is believed that several names of members and associates elected at the Bethlehem meeting in August, 1871, have been accidentally omitted by reason of the loss of a portion of the records of that meeting, Such persons, or their friends, are requested to communicate with the Secretary.

II. All members and associates who have not paid their dues are requested to do so at once, by sending in postal orders, or check, or money, ten dollars to the Secretary.

All members and associates who pay their dues for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute, and all notices of meetings. Back numbers cannot, as a general rule, be sent.

III. It is expected that the more important papers read before the Institute, and the debates thereon, will be published in annual or semi-annual volumes, to which those members and associates will be entitled who have paid their dues.

IV. Authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

MARTIN CORYELL, Secretary, Wilkesbarre, Pa.

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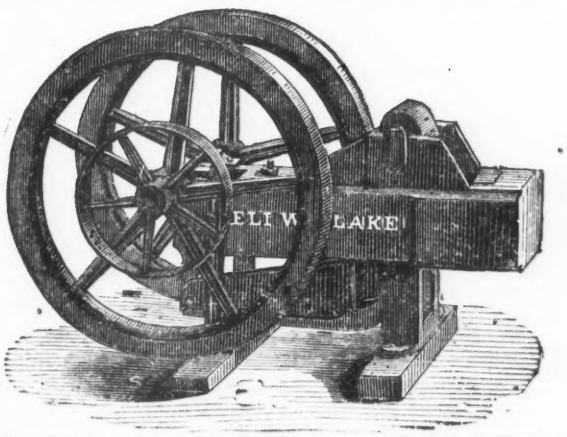

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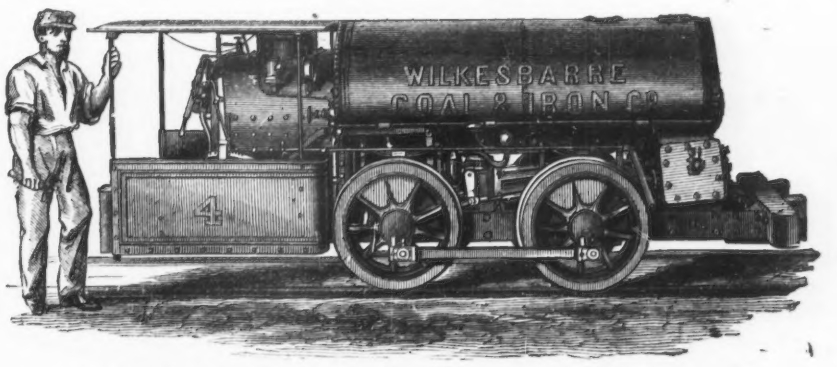

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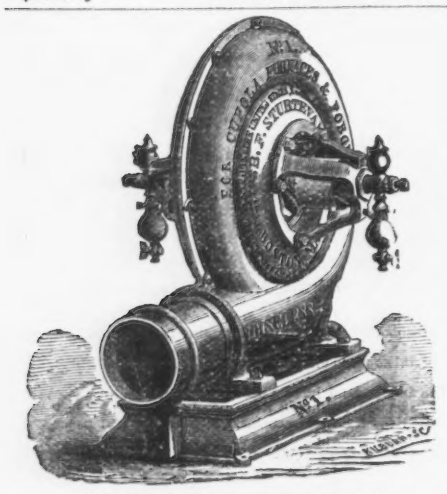

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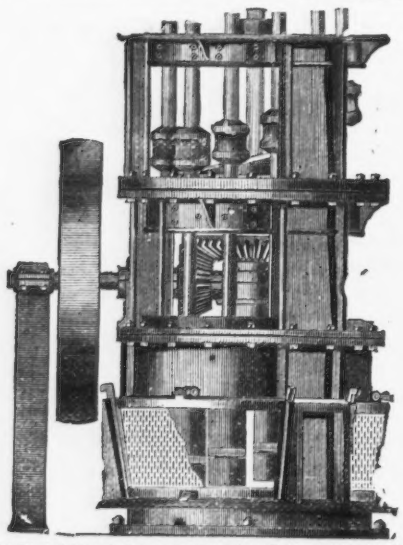

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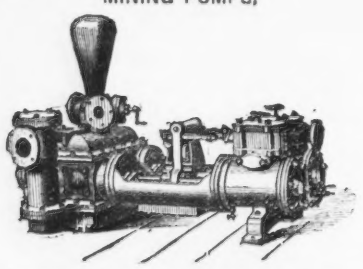

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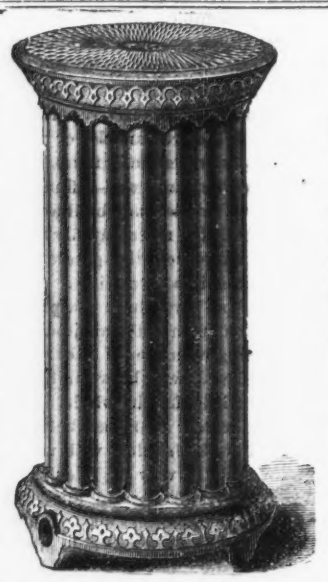

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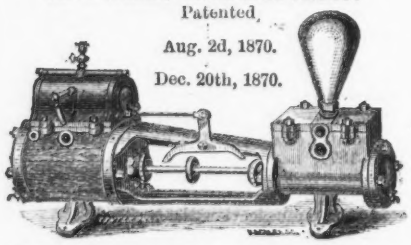

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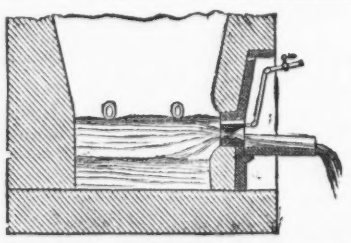

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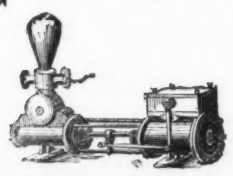

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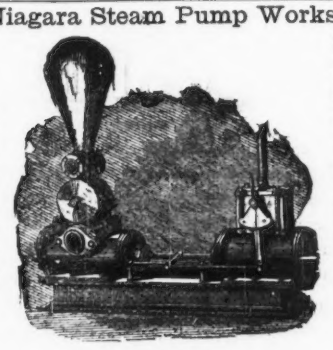

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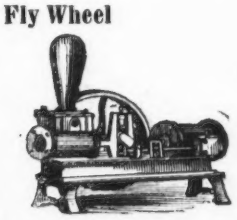

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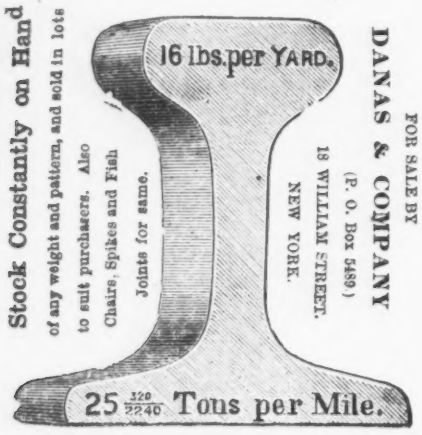

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